

**THE ROLE OF DIGITAL FINANCIAL SERVICES IN ENABLING RURAL FEMALE FARMERS' HOUSEHOLD FOOD ACCESSIBILITY.
THE CASE STUDY OF NYERI COUNTY, KENYA.**

A research project submitted to Van Hall Larenstein University of Applied Sciences in partial fulfilment of the requirements for the degree of Master in Management of Development, Specialization Rural Development (MOD) - Food and Nutrition Security (FNS)



By

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Acknowledgement and dedication.

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Acronyms.

DFS: Digital Financial Services.

FAO: Food and agriculture organization of the United Nations

WPF : World Food Program.

RFF: Rural Female Farmers.

FCS: Food Consumption Score.

Abstract.

This research was conducted to explore the role of digital financial services in enabling rural female farmers' households access food in Nyeri county. The findings from the case study , Focus Group Discussion and key informants revealed that they use Mpesa mobile money : rural female farmers Mshwari and Fuliza overdraft facility, Mobile lending apps Tala and Branch . Bank agents and mobile banking apps: Eazzy banking are also used. Mpesa mobile money is used to access digital loans, save money which earns interest, send remittances and make transactions .

Rural female farmers use finance obtained from Digital Financial Services to purchase food. Households experiencing food shortage due to vulnerability: shocks (climate change, illnesses death) and seasonality (increased food prices, fluctuating income from agriculture) use DFS to access food. Fuliza overdraft facility is used to complete transactions to purchase food with a deficit balance on Mpesa. Mshwari savings which earn interest are drawn upon during food emergencies.

The digital loans are used to invest in agriculture: to purchase farm inputs such as fertilizer. Quality inputs have potential to increase agricultural production. However, there was no evidence of relationship between investments in agriculture and output. In addition, high output does not automatically lead to high income to purchase food . Price fluctuation of coffee could affect the price of yield. Hence, taking a loan of DFS to invest in agriculture could be a risky investment with no positive outcome.

Access to loans on DFS enabled rural female farmers to diversify their portfolio and engage in non-farm activities . This enables them to spread them to become resilient when agriculture fails due to shocks such as climate change. Households are able to earn extra income to supplement income from agriculture. Hence economic access to food.

Households with access to remittances reported having higher purchasing power to access diverse food types that otherwise they could not have access to . Access to mobile money decreased the likelihood of households changing their diet or skip meals to deal with shocks The food consumption score showed that the households experience less episodes of hunger as most of the score was above borderline.

The strengths, weaknesses, opportunities, and threats of using Digital Financial Services found that they have the strengths in enabling farmers access quick digital loans to invest in agriculture. They also enable users to receive remittances and make transactions to purchase food. Conversely, Digital Financial Services demonstrated weaknesses and threats in illiterate farmers who reported experiencing difficulty in using them. Mobile lending apps rely on internet networks which is not affordable to the rural female farmers. Lack of economic capacity to purchase smart phones and charges associated with using DFS: high interest rate. Short loan repayment period prevent rural female farmers to use mobile lending apps.

The researcher recommends the commissioner to use gender lens and disaggregated data to ensure gender mainstreaming to implement the National Food and Nutrition Security five-year plan. Collaboration by partnering with Digital Financial Services providers to ensure digital and financial literacy of rural female farmers to ensure they have the proper skills required to use the apps. Financial literacy will enable the Rural female farmers to avoid being trapped in debt by taking loans which might be difficult to repay. Ensure access to stable and affordable internet connection in the village. Provision of stable mobile data and internet connections will ensure access to mobile lending apps.

Keywords: Digital financial services, food accessibility, food consumption.

CHAPTER 1: INTRODUCTION

This chapter describes the background, the research context, research problem, objective and research questions which were studied.

1.1 Background.

This study focused on the role of digital financial services in food accessibility among rural female farmers. It also explores the factors that enhance or hinder rural female farmers from using digital financial services.

1.1.1 Research context.

Rural female farmers play a significant role in agriculture by producing approximately 80 per cent of food yet they make 60 percent of chronically hungry people in developing countries (World Bank, 2017). In spite of the important role women play in agriculture, they lack equal access to financial resources (Huyer, 2016). They lack access to formal savings and credit, which limits their ability to manage shocks and invest in farming (World Bank, 2021). Rural female farmers are prone to seasonal hunger gaps exacerbated by vulnerability to shocks from adverse climate changes (Owusu et al., 2021). Access to financial resources has potential to raise agricultural production to 4 per cent in the poorest regions and malnourishment reduced to 17 percent (United Nations, 2021).

According to the World Bank global index (2017), 56 per cent of all unbanked adults are women. Women in Kenya lack collateral such as land to access loans due to customary laws that discriminate them against property ownership rights (Gaafar 2014). Women's access to finance/resources is limited due to cultural, traditional and sociological factors. Access to credit is constrained because national legislation and customary law exclude women from owning property consequently cannot provide the collateral required by lending institutions (Manuel, 2015).

Kenya has experienced a boom in growth of Digital financial services (DFS) with the emergence of mobile money, banking agents, mobile lending apps offering financial services (Communications Authority of Kenya 2017). Mpesa Mobile money was launched in 2007 which offer money transfer services, saving accounts with interest and loans. In 2013, Safaricom Mpesa launched M-Shwari a savings and lending account. In 2019, Fuliza account launched which is an overdraft facility which allows users to complete transactions with insufficient balance (Kenya Financial Sector Deepening 2016). Equity Eazzy Banking app and loan apps such as Branch and Tala also penetrated to rural areas in 2019. A study conducted by the Consultative Group to Assist the Poor in 2018 estimated that one in three mobile owners in Kenya borrows money from their phone.

Digital financial services (DFS) enable the financially excluded people in rural areas access services where banks are absent (Demirgüç-Kunt et al., 2017). DFS enable the rural poor to have occupational choices, improve welfare and invest in entrepreneurial ventures (Ouma et al., 2017). Mobile money has played an important role in strengthening women's financial inclusion by enabling them to access financial services independently without their husbands to conduct financial transactions (GSMA, 2017).

Digital Financial services play a pivotal role in household food accessibility with platforms such as Mpesa credited for reducing episodes of hunger by smoothing consumption through savings (Suri and Jack 2016). According to FAO (2015) financial services help female farmers increase their income security, which can lead to better household nutrition. Mobile money facilitate financial participation to diversify their assets and become resilient to shocks (Rutten, 2012).

Kenya is divided into 47 counties: Nyeri where the research took place. It is located in the central highlands of Kenya in the slopes of Mt. Kenya and the Aberdare Ranges. Agriculture is an important sector because it employs approximately 66% of the labour force and contributes to about 57% to

households income (Government of Kenya report, 2021). The main source of livelihood is cash crop farming such as coffee and tea (County government of Nyeri report , 2021).

In Kenya women are more vulnerable to food inaccessibility due to socio-cultural norms which deny them rights to own property such as land which act as collateral to acquire loans for agriculture (World bank 2019). According to a survey by the Agricultural Sector Development Support Programme (ASDSP) in 2019 , more than half of the households in Nyeri interviewed did not have enough food due to Covid 19 and drought.

The county government of Nyeri seeks to achieve zero hunger to achieve the sustainable development goals vision 2030. It has a five year plan for the implementation of the National Food and Nutrition Security (NFNS). The county integrated development plan in conjunction with department of finance and economic planning strives to achieve financial inclusion and household economic food accessibility for rural women.

1.2 Problem Statement.

According to FinAccess Household Survey report (2021) rural female farmers in Kenya have low income, savings and limited access to loans. Lack of access to loans limit farmers from making investments that could potentially increase crop yields and improve food accessibility (FAO 2020). Access to credit is constrained by social cultural norms which exclude women from property ownership and consequently cannot provide the collateral required by lending institutions (Youssef, 2018). The rural female farmers yield low harvest due to lack of financial asset to invest in irrigation , inputs such as improved seeds, fertilisers and pesticides is limited. Rural female farmers are also more likely to obtain lower prices for their crops.

Rural female farmers experience economic food inaccessibility due to low income from agricultural production of coffee and tea (Nyeri County government report , 2021). Low income reduce the purchasing power to buy food and invest back in agriculture (Kenya National Bureau of Statistics, 2020). In addition, the food they produce is not sufficient to last all year hence experience annual hunger gaps and end up purchasing food before the next harvest.

income is subject to shocks, where social safety nets are few and unreliable and other financial substitutes are negligible, and where the outcomes of income fluctuations can be more severe. (Bharadwaj et al 2019)

The county government of Nyeri seeks to end hunger in the region in order to achieve the sustainable development goal 2 for zero hunger for vision 2030. It seeks to understand how Digital Financial services contribute to rural female farmers livelihood strategies and outcome :income and access to food. It lacks knowledge on the role Digital Financial services paly in food accessibility among rural female farmers in the county.

1.3 Problem owner.

The county government of Nyeri promotes food security by implementing projects and strategies towards achieving the sustainable development goals 2 for alleviating hunger as per vision 2030. It seeks to understand how Digital Financial services contribute to rural female farmers ability to access food. The county government has a five-year plan to implement the National Food and Nutrition Security in conjunction with the ministry of finance and economic planning.

Hence, commissions the researcher to conduct research on the contribution of Digital Financial services towards rural female farmers livelihoods and ability to access food. The results and

recommendations from the research will be used during the implementation of the five-year plan to implement the National Food and Nutrition Security and for interventions to ensure food accessibility among the rural female farmers.

1.4 Justification of the study.

The use of DFS has rapidly grown in the past 5 years in Nyeri county with mobile money, mobile lending apps and bank agents being used by rural female farmers as a source of financing. This study is unique because it assessed the role of different DFS used among rural female farmers in Nyeri to attain economic food access unlike most publications which focus on general household food security. The study aimed to describe the contribution of digital Financial services towards rural female farmers livelihoods and ability to access food. The findings of this study will bridge the knowledge gap about the use of digital Financial services as a source of financial asset in improving food access and livelihood strategies by rural female farmers. The research will also enable the farmers share their challenges on use of DFS to improve the services with county government. The findings of the research and recommendations for interventions will support rural female farmers in economic food access.

1.5 Research Objective

The objective of this research was to gain insights on the contribution of Digital Financial services to rural female farmers access to financial asset to access food. It aims to give recommendations to the county government to assist in designing interventions to reduce hunger in the region.

1.6 Research question.

Main research question.

1. What role do Digital Financial services play in enabling rural female farmers household access food in Nyeri county?

SUB QUESTIONS.

1. How do rural female farmers utilize the digital financial services to access food?
2. How access to Digital Financial services affect Food Consumption in rural female farmers household in Nyeri county?
3. How rural female farmers use Digital financial service to improve their livelihood strategies to achieve outcome: income to access food?
4. How rural female farmers use Digital financial service to diversify their Livelihoods to increase income to access food?
5. What are the strengths, weaknesses, threats, and opportunities for rural female farmers using DFS in Nyeri county?

CHAPTER 2. LITERATURE REVIEW

2.0 Introduction.

This chapter reviewed literature related to the role of digital financial services in enabling rural female farmers access food. The research explored key concepts which are critical in the operationalisation of indicators.

2.1 THEORETICAL REVIEW.

The researcher reviewed the work of various authors who have written on the contribution of digital financial services towards food accessibility among rural female farmers.

2.1.2 Role of Digital Financial Services in Food accessibility.

Digital financial service enable rural female farmers to save and borrow digital loans thereby smoothing their consumption and invest in entrepreneurial ventures (Ouma et al., 2017; Wyman, 2017). FAO (2015) asserts that financial services can help rural female farmers increase their income security, which can lead to better household nutrition.

A study in Ghana by Sakyi-Nyarko in 2022 Investigating the implications of mobile money access on household welfare showed resilience to shocks and outcome in food consumption. Digital financial services cushion households from food inaccessibility and reduce episodes of hunger by smoothing consumption through savings (Suri and Jack 2016). A study conducted in Kenya by Suri and Jack in 2016 on the long-run poverty and gender impacts of mobile money found a positive relations between use of mobile money and household access to food .

Baffour (2020) argued that use of mobile money among poor households improve per capita expenditure and household consumption . A study in Uganda on the effect of mobile money reduced the percentage of households with low food access in areas without banks (Wieser, 2019). In Niger, Aker et al. (2016) have shown that food diversity was higher among households receive ng mobile transfers.

A study in Zimbabwe harnessing Mobile Technology to enhance the sustainable livelihood of rural women farmers showed improved savings and household wellbeing (Musungwini, 2014). Bharadwaj (2019) indicates that digital loans in Kenya improve household resilience: households are 6.3 percentage less likely to forego expenses due to shocks. A study in Uganda investigating the impact of mobile money access on household welfare found a positive and significant effect on household per capita consumption (Munyegera 2016).

The implication of the study was important in enabling the researcher to report the findings.

2.1.3 Role of Digital Financial services in rural female farmers livelihoods.

A study by Afawubo et al. (2019) in Togo concluded that mobile money users are less vulnerable to economic shocks such as drought, rain shortage and high prices of agricultural inputs. Another study in Uganda added new evidence that mobile money can improve livelihoods even in poor and remote settings (Wieser, 2019). Access to credit enable farmers to make investments that could increase crop yield (FAO 2015). Livelihood diversification reduces vulnerability to food insecurity and prevent collapse of livelihoods by providing basis for building assets as an exit out of poverty. DFS increased investment by 13 percent and boosted crop output by 21 percent (Brune et al. 2015).

Credit provides the liquidity needed for farmers to invest in farming equipment and inputs such as the fertilizer to improve crop yields. DFS also facilitate distribution of wages, social transfers, and subsidies to agricultural workers (Aker et al. 2014; Muralidharan et al. 2014). Digital payments tools create opportunities for smallholder farmers to more tightly connect to agricultural value chains.....

Savings accounts also in help farmers make bigger investments (Janzen , 2019). Savings enable farmers to manage expenses during the down season. A study in Mali found that households that were offered loans increased their investments and expenditures on agricultural inputs (Beaman et al. 2014). Access to finance improves rural women's livelihoods and deal with shocks (ibid; Islam et al., 2016).

This study is unique because it assesses the role of different DFS (mobile money, mobile agent and mobile lending apps) among rural female farmers to attain economic food access unlike most publications which focus on general household food security.

2.2 Definition of key concepts.

In this paragraph the researcher explained the key concepts used In the study to understand the specific meaning of terms. The key concepts that were used in the study include the following:

Digital financial services.

For this study Digital finance services are defined as products, software, and customer interaction and communication services provided by FinTech companies and innovative financial service providers (Gomber et al, 2017). In this study The DFS includes: mobile money, mobile lending apps, agent banking and mobile banking apps.

Financial inclusion:

Financial inclusion is the process of ensuring access to financial services that are timely and adequate such as credit where and when needed (Sarma, 2015). For the purposes of the study financial inclusion is **defined** as availing financial services to the rural unbanked population.

Rural Female Farmers:

Women who are involved in agricultural production in the countryside (Doss, 2018). This study focuses on female headed households. The women are actively involved in agriculture in rural areas with capacity to make decisions in the land they cultivate.

Food security has four pillars but in this study we look at food accessibility because there is sufficient food available in the world but access is the problem (World Food Summit 1996) Gassner, et al . 2019.

Food accessibility is the ability to access and afford food which is influenced by factors such as prices and socioeconomic resources of food buyers (FAO, 2020) .

Mobile money: Mobile money is an innovation that provides financial transaction services via mobile phone, including to the unbanked global poor (Aron, 2018). For the purpose of this study, Mobile money focuses on Mpesa .

Mpesa

Mpesa is a mobile banking and payment system using data preloaded on the SIM card and is SMS based interface to transmit money virtually to other phones (Hinz, 2014).

M-Shwari is **defined** as a financial product that serve poor, rural, and financially underserved Kenyans. For this study, and within the context of **M-Shwari**, financial access (Nan, 2019).

Fuliza

Fuliza is described as an overdraft facility from Mpesa (Donovan, 2022). In this study, Fuliza is an overdraft facility that allows users to complete transactions with a deficit account

Mobile lending apps:

For the purpose of this study Mobile based applications with user interface that enable lenders to install the app on their smart phone to borrow money which are viewed as banks in one's pocket.

This research focused on the role of DFS in achieving food accessibility pillar among rural female farmer because it has potential to ensure access to digital loans and savings with interest in order to achieve zero hunger sustainable development goal 2030. (The United Nations Conference on Trade and Development 2017).

2.3. Conceptualisation of Concepts and Operationalisation

2.3.1 Using the conceptual framework to analyse the role of digital financial services in attaining food accessibility among rural female farmers.

The framework outlined the inter-linkages between DFS, financial asset, livelihood strategies and desired outcome of food access. The framework assisted the researcher to explore the role of DFS in attaining food among rural female farmers. Understanding financial practices among rural female farmers is important in unravelling why food accessibility remains a challenge.

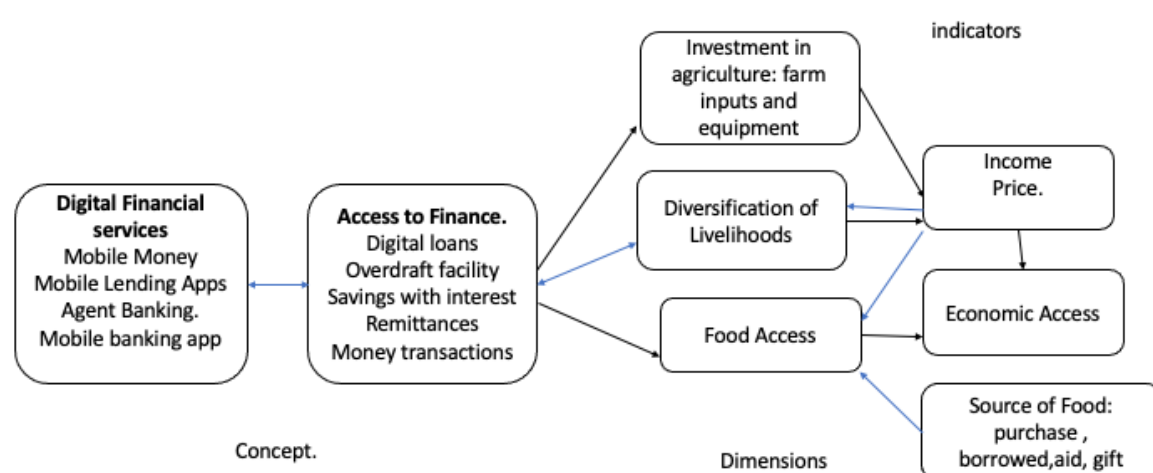


Figure 1: Conceptual framework

Source: Author 2022.

2.3.2 Dimension of Food Accessibility

According to Gross R. (2000), Food accessibility is achieved when all individuals within the households have sufficient resources to obtain appropriate foods for a nutritious diet .

The world produces sufficient food to feed everyone, however access to food remains a challenge (FAO 2009).

Economic food access Economic food access is the financial capacity to purchase sufficient food for household consumption (Oxfam, 2007). Poor farmers who making less than \$2 a day lack capacity to buy food(FAO 2009).

The study examined the economic food access aspect and explore the role DFS in providing financial asset for rural female farmers in order to buy food for the household.

2.5 Strengths, Weaknesses, Opportunities and Threats (SWOT) of using DFS among rural female farmers.

SWOT analysis is a tool used to assess the Strengths, Weaknesses, Opportunities, and Threats. For the purpose of this study, SWOT tool was used to analyse how digital financial services contribute to food accessibility.

2.5.1 Strengths

Digital financial services enable financial inclusion of smallholder farmers who are unbanked by granting access to credit (Sam, 2021). Digital financial services benefit rural women of having a savings account. DFS bridge the financial inclusion gender gap in smallholder agriculture which is untapped potential for sustainable development (Adegbite, 2020).

2.5.2 Weaknesses

Use of DFS is associated with unaffordable fees charged by **digital financial services** providers and **financial illiteracy** hinder their effectiveness (Ozili, 2018).

2.5.3 Opportunities .

Mobile money enhance the ability to deal with shocks, consumption smoothing after a shock (Riley 2018) Coping strategy, absorb shock, build household resilience. DFS enable the farmers to make transactions, save money, save their time and increase their purchasing power to access food. Risk sharing through mobile money transactions between household members experiencing shocks.

A study by Riley (2018) found that using mobile money enhance the ability to deal with shocks, consumption smoothing after a shock. A study exploring fintech solutions for women indicated that low cost digital financial services (DFS) such as mobile money to close gender gaps in financial exclusion. (Analytics, 2018.)

DFS offers an opportunity to close the gender gap in financial inclusion of women farmer's and contribute to 16% agriculture productivity gaps between men and women farmers (Mndolwa, 2017.)

2.5.4 Threats

DFS services are not provided in local languages which pose a language barrier identified as the threat of mobile apps whereby these apps require a translation which leads to dependency that reduces acceptability and popularity (Kalyan & Neela, 2020)

A study by Yue et al, (2022) found that DFS increased the risk of the households being trapped into debt. Opati, (2022) also found similar evidence that digital loans trapped customer base in the debt trap, inflated pricing model, high interest rates, and short-term loan tenures.

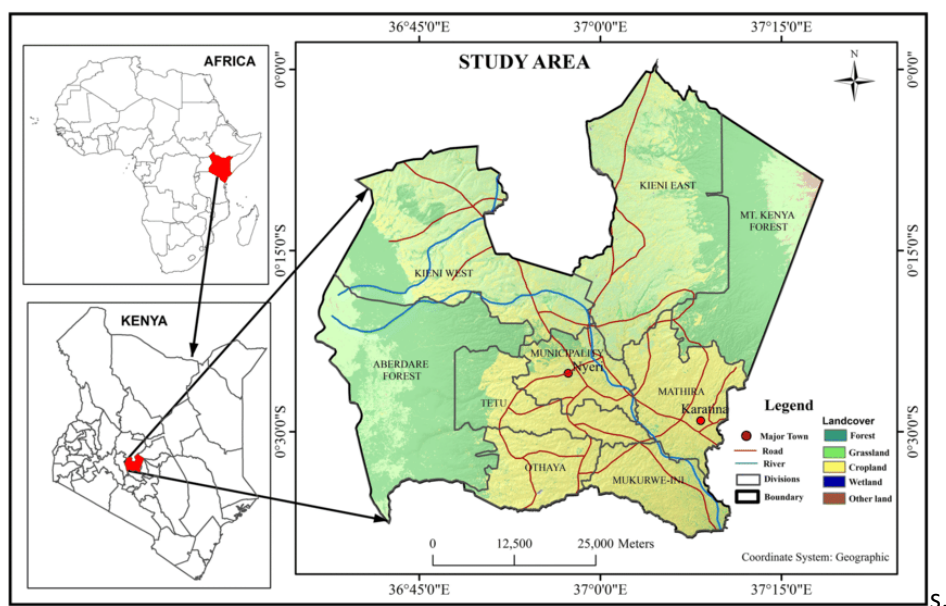
CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction.

This chapter encompasses the study area, research strategy, design and methodology that were used in the study. It explains the data collection technique, sampling design, and sampling method. Finally, it indicates the sample size, data analysis and ethical considerations.

3.1 Description of the study area

Nyeri county is located in the central highlands of Kenya in the slopes of Mt. Kenya and the Aberdare Ranges. It has a population of 759,164 and an area of 2361 km². The main cash crop grown are coffee and tea. The county has 8 sub counties. The research focused on Mukurwe-ini sub county due to high statistics on food inaccessibility and unbaked population among rural female farmers recorded in the county 2021 report. The commissioner is interested in Muthuthi-ini village in Gikondi ward because of the high level rural poverty and underdevelopment. DFS were introduced to facilitate access to finance to stimulate rural development in the region.



Source: <https://link.springer.com>

3.2 Research strategy.

The research used a case study research design which enabled the researcher to conduct in-depth investigation of phenomena within some specific context, a group or individuals

(Rashid, Y 2019). A case study was used because it was suitable to acquire in depth knowledge on the use of DFS in contributing to food security in Nyeri county.

Case study.

The researcher used 10 case studies with 10 rural female farmers who use digital financial services. The researcher set up three interview sessions with the rural female farmers. The first interview was to create a bond with the female farmers and ask questions to profile them. Followed up with a semi structured interview session and lastly a final meeting for clarification of themes that came up during the previous interview.

3.3 Research Design.

The researcher used desk study to write the background of the study, the research problem and objective were agreed with the commissioner. The researcher reviewed the literature to come up with the conceptual framework, research question and identifying the research methodologies used in data collection. The researcher went into the field to collect data then collated, organized, analysed, and interpreted the results. The researcher made the discussion of findings and lastly made the conclusion followed by recommendations.

3.4 Research methodology.

The researcher used qualitative method in conducting the research. Qualitative method is used to collect non-numerical data to understand concepts, opinions, or experiences and can be used to collect deep information about a problem and can help to generate a new idea (Bhandari, 2020). The researcher focused on qualitative data to get in depth information, opinions and experiences from rural female farmers on the use of DFS and how they contribute to food accessibility.

3.5 Data collection techniques.

The study used triangulation of primary data and secondary data to ensure the credibility and validity of findings. Triangulation is a process of explaining human complex behaviours by combining various methods to give more understanding to readers (Helen & Roberta, 2019). Primary data was collected from SSI with rural female farmers, focus group discussions and key informants. The tools used for data collection included semi-structured interviews, focus group discussions and interviews conducted with key informants, food consumption scores, photo-elicitation.

Primary data

Primary data on the role of DFS on household food accessibility among rural female farmers was collected through: key informant Interviews, Focus Group Discussion, semi-structured interviews and observation. The primary data provided the researcher with first-hand information which will help triangulate secondary data sources.

Key informant interview

Key informants were interviewed to collect information who understood adoption of DFS and knowledge food accessibility. Mobile service providers, county official from department of agriculture, rural urban development and county development fund were interviewed. This helped to answer the research questions.

Semi-structured interviews.

Semi-structured interviews with 10 rural female farmers members were used to collect in depth information on use of DFS on food accessibility. The researcher approached the rural female cash crop farmers to ask them to participate in the data collection. Implications for your research? Did you focus on coffee? Link to cash crops? Explain this clearly. The researcher then explained the aim of

the study. The researcher chose to use 10 case study interviews in order to have deep information which was convenient to analyse in the three months research period. The checklist and semi-structured interview guide were the instruments used in conducting the research. The researcher asked open ended questions to the rural female farmers to gain insights on how they use DFS or how they access finance for farming and to access food.

Focus group discussions.

Two groups with 8 female farmers members each were used to obtain information on the role DFS play in food accessibility among the female farmers. The FGD members were selected from recommendations from farmers who participated in the SSI interview.

The Focus group discussion guide with a list of topics from the research questions was used to facilitate the interview session (in annex). The researcher recorded the interview and took pictures during the session.

Photo elicitation.

Photo elicitation is using pictures to generate verbal communication using images (Xanthe, et al., 2017). Pictures were taken during the interview sessions to show rural female farmers interacting with the researcher: demonstrating how they use mobile money, loaning apps and banking agents. Images of surroundings: farms, livelihood strategies were taken.

Then you may mention this earlier too.

Food Consumption Score

The food consumption score Sheet was applied to the semi-structure Interview respondent to. A structured questionnaire was used to record the type of meals and composition by the households. The food consumption score (FCS) aimed to measure the diversity and frequency of food groups consumed over the previous seven days. The FCS assessed the capacity of a household in accessing caloric availability, food frequency and nutritional importance of different food groups. The relevancy of FCS was to determine if there was a positive relation between the access to DFS and household food consumption. To calculate the food consumption score, the researcher grouped food in different categories and each category was attributed to its weight. The researcher then determined the consumption frequencies of each food and multiplied by their weight to determine the consumption score.

How does this relate to your sub questions

Timeline PRA tool on history use of DFS within 5years.

Time line will give a chronological order of when DFS were introduced in the village how it started, reason it is used, why it is not used in the villages and how things have changed positively and negatively? It will help give a history and background of the village in use of DFS for food access among rural female farmers. Finally it will show the evolution of use of DFS and trends among women farmers. A timeline of five years will be used to ensure accuracy of information since it relies on memory of respondents. Nice- with how many respondents? What stage?

3.6 Sampling design

The research used purposive sampling to select the farmers who participated in the research. Purposive sampling involves a non-random probability selection of respondents based on suitable

conditions permitting the researcher to easily access information (McCombes, 2019). The method was selected because of its ease in enabling the researcher access information. Explain how you did this. The sample was chosen through convenience sampling technique.

3.7 Sampling method

Convenience and Snowball sampling were used to select the respondents. The researcher requested respondents to recommend potential interviewees. Convenience sampling is non probability selection method that deals with choosing respondents whom the researcher is sure that they are easily approachable (Saunders, et al., 2017).

Key informants were selected via purposive sampling according to their department and position held. I entered the village through the introduction by the Village chief.

3.8 Sample size

The sample size was composed of 10 case studies semi structured interviews and 16 respondents from 2 Focus group discussions to enable the researcher collect in depth information in limited period of research. 4 Key informants were interviewed. The researcher was convinced that the information to be collected from these participants was sufficient to make relevant findings and conclusions.

3.9 Data collection process.

On 4th of July I started my data collection after receiving an introductory letter and permission from the county government to conduct research in the areas. I made initial contact with the respondents by explaining the objective of my study, asked for their participation, information to contact them and date of availability. I managed to set up an interview on that first day with one of the women. In the course of the consecutive weeks, I interviewed a total of 30 respondents. 10 semi structured interviews, 2 focus group discussions with 8 members each and 4 key informants.

The Language selected for interview was Kikuyu for responds who are not literate : to ensure equality and allow them to open up for the researcher to get as much information as possible. This will reduce power difference between researcher and respondents. English language was used to only with the key informants because that is the official language when interacting with government officials and it was easier for the researcher to transcribe by avoiding loss of information during translation.

3.10 Data Analysis methods

Qualitative data analysis was used through translation and transcription to English. Themes, patterns and categorised were identified to help answer the research questions. Content analysis tool used to quantify and analyse data collected from the primary sources: focus groups and interviews. In addition, the data collected was coded and keyed in to a grid for analysis. Lastly, the results from different data sources were triangulated from the SSI, FGD and Key informants.

3.11 Ethical Considerations

The researcher requested for a letter of introduction and approval from the county government of Nyeri to conduct data collection in the area. The researcher explained to the respondents exactly what was expected of them and ask for permission to take pictures and record videos. The respondents signed a consent form approving participation and use of data for the study. The researcher presented respondents with the consent form, which was signed by each one of them. Confidentiality and privacy was guaranteed to participants. No identification details that could be traced back to participants will be revealed.

Table 1: Sub questions.

Sub question	Expected information	Data collection method	Source of information	Data processing
1. How do rural female farmers utilize the digital financial services to access food?	Ways the finance obtained from DFS is spent on accessing food	Case study	Rural female Farmers	Coding
		Focus Group Discussion.	Rural female Famers	Content analysis
		Semi-structure interview	Key informants	Coding
		Photo elicitation	Rural female Famers	Content analysis
2. How access to Digital Financial services affect Food Consumption in rural female farmers household in Nyeri county?		Case study Semi structured interview.	Rural female Farmers	Coding
		FGD	Rural female Farmers	Content analysis
		Food consumption score	Rural female Farmers	
		Semi-structure interview	Key informants	Coding
3. How rural female farmers use Digital financial service to improve their livelihood strategies to achieve outcome: income to access food?	Income Agricultural production.	Semi-structured interview Case study	Rural female Farmers	Coding
		FGD	Focus group members	Content analyses.
		Semi-structured interview	key informants	Coding

4. How rural female farmers use Digital financial service to diversify their Livelihoods to increase income to access food?	Activities: farm and non-farm.	Case study	Key informants	Coding
		Semi-structure interview	Rural female Farmers	Coding
		Focus group discussion.	Rural female Famers	Content analysis
5. . What are the strengths, weaknesses, threats and opportunities for rural female farmers using DFS in Nyeri county?	Challenge, benefits of Rural female farmers in using DFS.	Semi-structured interview guide	-Farmers	- Coding
		- FGD	-Focus group members	- Content analysis
		Case study	Key informants	- Coding

Table 1.

3.12 Limitations

During the data collection, the researcher was faced with limitations while conducting the study. Although the researcher was aware of the elections and scheduled interviews prior with the key informants, there was fear of post-election violence. Some key informants were working from home. A public holiday was announced right before the elections which the researcher did not anticipate hence interviews had to be rescheduled to after elections. It was not possible to have online meetings at the time. This inconvenienced the researchers' plan as they had to travel back to the Netherlands. The topic of finance and food accessibility is a taboo to talk about. There is stigma in having loans; it is viewed as a sign of poverty which could lead to social exclusion. People are not open to discuss about money matters candidly. Asking the respondents about the food they ate was intrusive.

CHAPTER FOUR: RESULTS AND FINDINGS

4.0 Introduction.

This chapter contains the results and findings from the topics that emerged during the research. The data is presented according to sub-questions.

4.1 Profile of respondents from the case study semi-structure interview.

Background of the 10 Case Studies with Rural Female Farmers.

The case studies contain 10 stories of the Rural Female Farmers life history, timeline, and trend analysis of using DFS. Code names were given to the Rural Female Farmers. Their names were changed to protect their identity.

Case Study 1.

"Mobile money is a bank at hand"

Name: Mumbi.

Age: 44 years.

Village: Muthuthiini, Gikondi.

level of education: High school.

Marital status: Married. But my husband migrated to Nairobi the capital city for work.

Number of children: 7 children.

livelihood strategies: Coffee and dairy cows' farmer.

Topical history / Timeline for using Digital financial services.

I started using Mpesa mobile money: Mshwari and Fuliza Mpesa in 2019. I also use mobile lending apps: Tala and branch since 2020 to acquire emergency loans. I heard an advertisement on the radio when the services were launch. I received training from the Safaricom team which was educating people on their invention as they were looking for new consumers. I started using the DFS when I was experiencing financial difficulties. I needed funds to transport produce to the market and pay for labor. I use digital financial services to make transactions: Sending and receiving money. I also use Mshwari for saving purposes which earns interest of 6.3% p.a when I save \$10 and above.

Use of digital financial services in household food access.

I receive money via Mpesa from my husband who lives the city (Nairobi) monthly to purchase food. I normally purchase food items which we do not normally consume such as bread, yoghurt, fruits and other food items which are expensive to buy often. My household is able to consume all three meals in a day without having to consume less nutritious food. During periods of vulnerability: due seasonality in agricultural income fluctuation, increase in food prices, I use Fuliza overdraft facility to complete transactions at the food market when my Mpesa account balance is insufficient. This enables me to buy the amount of goods I intended to purchase instead of leaving the market without since I did not have enough money. Access to DFS enables me to sustain my households' food consumption.

Use of digital financial services in farming.

I take digital loans on Mpesa mobile money and Tala lending app to purchase farm inputs such as fertilizer, pesticide, pay for labour during harvest season, purchase storage facility and transport coffee to the factory. I also diversify my portfolio by using the loans in dairy farming.

Role of DFS in improving Livelihood strategies: agricultural production.

There are many factors that affect agricultural production. I would not owe it to one single factor.

For instance, in the past when I did not have the option to access loans through Mpesa, I would have difficulty paying for unforeseen expenses in the farm. Now that I can get a quick loan, immediately with no requirements it is easier to purchase what is required in the farm but no guarantee in high produce.

Livelihood diversification:

Coffee farming is not a sustainable source of income on its own. I recently took a loan on Mshwari to purchase a dairy cow for milk. Income from sale of milk acts as supplementary income to access food.

Benefits and Challenges of using DFS.

Since there are no banks here in the village, Mpesa is like a bank at hand. If you have cash at hand, it is risky you end up making impulse purchases. If you deposit money on Mpesa, you remain with only the cash you require. Money is more secure on MPesa, you cannot be extravagant, you avoid buying things you had not budgeted for. DFS are cheaper, loans are sometimes 12% from traditional banking systems.

At first, I was skeptical of using DFS because it was a new technology that I was not familiar with. Also, there were many complaints from users who lost money when they made errors entering the mobile number to send money and there was no reverse key at the time. There were scammers who called and acted as customer care demanding payments on another number and asking for pin and registration details: ID number, date of birth. I have personally received a forwarded text message where the sender claimed to have sent me money by accident and I should forward back the money. I tried to reverse but my balance was zero. That is how I found it was a scam. If I had money, I could have lost it during the reversal process.

Mobile lending app repayment period is short and defaulting on a payment, one is put on the Credit Reference Bureau list and labeled risky borrower. This makes it hard to receive a loan in the future. High interest on repaying the loans on the mobile apps and the mobile money at 7.5%. When I take a loan of \$100, I repay \$75. The amount increases each day you delay repaying. At times I end up paying interest as high as the loan itself. If you have a loan on Fuliza and you receive money on Mpesa, they first deduct the loan. So, if you had planned to use the money for other purposes you have to find an alternative.

Case Study 2.

“Mpesa came to make our lives easier by helping us make money transactions at the comfort of our homes.”

Name: Wanjiru.

Age: 36 years old.

Village: Muthuthiini, Gikondi.

level of education: Primary school

Marital status: Divorced.

Number of children: 5 children.

livelihood strategies: Coffee and tomatoes farming.

Life history and timeline of Using DFS.

I started Mshwari and Fuliza in 2020. My elder son taught me how to use applications. I use Mpesa to make transactions and access loans to purchase fertilizers and hire a tractor for farming. Access to quality farm inputs contribute to increased yield.

My son who lives in the city sends me money for food via Mpesa. I recently used Mpesa to get a loan to buy and plant 174 coffee Batian stems and to purchase drip irrigation.

During periods of shock for instance during illness in my household, when I spend money set aside for food on hospital expenses, I draw on my savings on Mshwari when my household is out of food.

Access to quick loans definitely plays a role in boosting my agricultural production if other enabling factors such as favorable climate are present.

Mpesa is convenient because I can make transactions and access loans at the comfort of my house. I do not need to travel to the bank and apply for a loan and fill paper work. Once the loan is approved its sent to me instantly.

Coffee farming is not a sustainable source of income due to shocks as rainfall shortage since farming in Nyeri county is rainfed, failure of crops and price fluctuations. High output does not automatically lead to high income to purchase food . Price fluctuation of coffee could affect the price of yield.

Case Study 3.

Name: Wangui

Village: Muthuthiini, Gikondi.

Age: 40 years old.

level of education: Highschool.

Marital status: Single.

Number of children: I have 6 children.

livelihood strategies: Coffee farming and dairy farming.

TOPICAL HISTORY /TIMELINE OF DFS.

I started using mobile money and lending applications in 2019 and 2020 respectively. I use Mpesa mobile money, Tala, and Branch. However, I tried using Airtel money but there are not many airtel agents here in the village. My Friends introduced me to the apps and taught me how to use them.

I use digital financial services to make transactions, save and acquiring loans.

When I am experiencing food shortage in my household, I will draw on the savings on my Mshwari to buy food. I also take small loans mshwari to buy food items when I have no money.

Having access to DFS at any given time and place is an enabling factor in improving my coffee production since I can easily acquire funds to purchase inputs and pay for labor and transportation to the market. However, having sufficient capital does not necessarily lead to increased yield.

Initially when I started using DFS, it was difficult to maneuver through the platform. There are often new changes made to the platform which are difficult to keep up with. Sometimes the applications fails or its down for update for about 24 hours and during this period you cannot make or receive any transactions. I worry about the safety of the app. There are times when the consumers can get products for free when the system is down. Fraud is a major challenge. Customers have reported to receiving calls from individuals who claim to be Mpesa customer service.

The cost associated with using DFS. There is a double fee for using dfs: for sending and withdrawing the hard cash. The interest rate when repaying the loan is also high which increases daily when you fail to repay the loan in time. However, DFS are relatively cheaper in comparison to traditional banking. Loans from traditional banking systems are higher. Using mobile lending apps is difficult due to lack of stable internet or mobile data

When all my 6 children are going back to school, I spend a big percentage of my income on school fees. This reduces the amount of money available for food. I normally use Fuliza overdraft facility to buy food for the household consumption.

Case Study 4.

Name: Njeri.

Village: Kaharo, Gikondi.

Age: 42 years old.

Level of education: High school level.

Marital status: Separated.

Number of children: 7 Children.

livelihood strategies: Coffee farming and hairdressing.

Life history and timeline of Using DFS.

I started using Mshwari and Fuliza Mpesa in 2019.

My husband at the time introduced it to me. It was the easiest way to send me money for food and other farm expenses. I also use DFS to save and acquire loans.

I was in search of a quick loan and a friend recommended me to Mobile money digital loans. I lacked collateral and my husband could not agree to cosigner for the loan at the bank. Without meeting the requirements, I could not qualify for the loan.

I enjoy the privacy and anonymity of the service. Nobody knows that I am experiencing financial troubles.

I pay my farm workers during harvest season using Mpesa mobile money.

Accessing funds combined with enabling environment to contribute to higher yield but it is not a guarantee. Access alone to finance alone does not automatically lead to higher yield.

Coffee payments are not made monthly, hence I need alternative sources of income. Sometimes I am not paid well and other times not paid at all. Therefore, I use Tala to access loans to start engage in non farm activities such as hairdressing to earn income to purchase food .

Advantages: DFS loans are comparatively affordable /lower in comparison to banks. DFS are convenient way of getting an overdraft or loan at any time and place. It saves me the shame of approaching people asking for money. No one must know when I am experiencing financial difficulties.

Challenges of using the DFS.

It is not beginner friendly: lot of information for new users is not up front. You learn as you go. The application can be too simplistic such that it does not include critical information. For instance, Mpesa does not let the users know prior when applying for a loan that a daily delayed in repayment leads to a penalty. The interest grows fast, and one ends up paying way more money close to the original loan itself. The hidden fees and charges associated with the loan. For instance, when I take a loan, I am charged interest, If I chose to withdraw the money at an Mpesa agent I incur a cost, If I decide to send the money to third party, I still incur charges. The transactions alone can be hefty.

I recently got separated from my husband who was the breadwinner. When my income is not sufficient, I use Mshwari and Fuliza to take a quick digital loan during emergencies and use the money to buy only basic food commodities for survival such as flour.

CaseStudy 5

Name: Wambui.

Age: 38 years old.

Village: Kaharo, Gikondi.

Level of education: Primary school.

Marital status: Widowed.

Number of children: 6 children.

livelihood strategies: Coffee farmer and basketry.

I first used Mshwari and Fuliza overdraft facility 2020. My children explained to me step by step on how to use the technology. I use the digital financial services for transaction purposes to save, as a draft facility and to access quick loans. During Covid 19 pandemic, banks closed, and the only alternative was to use Digital financial services.

I use Mpesa to receive money from my children in the city to purchase food. During periods of shocks, such as when my husband died, I appeal for financial support from relatives to have sufficient money to purchase food. I use the overdraft facility to pay for groceries at the market when I do not have a sufficient balance.

Benefits of using DFS.

I can easily use the overdraft facility and take a loan to buy physical assets to use in the farm such as storage facility and equipment which would otherwise not be possible.

DFS are comparatively cheaper in comparison to banks but there are hidden costs that users are not aware of until after use. Accessing quick loans plays a role in boosting my agricultural production if other enabling factors such as favorable climate are present.

Challenges in using the DFS.

The Mpesa application is poorly structured: it does not let you know the costs you'll incur in advance. You only get a notification after a transaction. It is not beginner friendly since it has a lot of information is not displayed up front. You only know it after using it for some time. It has small hidden charges that can add up to be substantial. Knowing that I can always use the overdraft facility and take a quick loan at any time makes me fall in the trap of impulsive purchasing unnecessary things that I do not really require.

Case study 6.

Name: Wanjiku

Age: 36 years old.

Village: Muthuthiini, Gikondi.

level of education: High school.

Number of children: 4 children.

livelihood strategies: Coffee and dairy cows for milk farmer.

Role of DFS.

I started using Mshwari and Fuliza overdraft facility 2019 because of the collapse of the womens' self-help group. The treasurer defrauded us and left the village with all our savings, and I could no longer take a loan from the pool of funds. I made the switch to DFS due to unreliability of the merry go round in the village. It is less likely for an established app to defraud users since it can be sued. There is evidence of transactions. As opposed to the village savings where there was no evidence except with the treasurer who was the bookkeeper. We had no evidence of the transactions we made hence we could not go to court.

I learnt to use DFS by following the instructions on the application. When I registered for Mpesa I got a manual on how to use the services.

I use Mpesa for transaction purposes, to save, as an overdraft facility and to access quick loans.

During periods of vulnerability such as increase in food prices, I result to the Fuliza overdraft facility to pay for groceries at the market when I do not have a sufficient balance.

Mpesa is reliable and legitimate service. I do not have worries about being defrauded by the service providers. I have peace of mind.

The weaknesses of using the DFS is that information is scattered and there is no place on the application with full information on use, transaction costs and repayment terms. You must rely on the notification message after transaction or knowledge from other users who have made similar transactions. Accessing funds combined with enabling environment to contribute to higher yield but it is not a guarantee.

Casestudy 7.

Name: Waithera.

Village: Kaharo, Gikondi.

Age: 30 years old.

level of education: University graduate.

Number of children: 0 children.

livelihood strategies: Coffee farming and business enterprise.

TOPICAL HISTORY /TIMELINE OF DFS.

I first started using Mpesa, Equity agent and Eazzy banking app in 2020. I went to the Equity agent and asked her to explain to me how it works. For Eazzy banking app I downloaded the App and maneuvered it by myself. I use Equity agent purposes to withdraw and deposit money in my account without going to the bank branch. Eazzy banking app for transactions. I use Mshwari to access loans to go into business. I use Equity agent to withdraw money to purchase food and Eazzy banking app to make transactions.

Coffee proceeds are paid quarterly, hence I need an alternative source of income to ensure my household has access to food before my next pay day. I use Mshwari and Fuliza to access loans to set up a business in trade the shopping centre

Equity agent s are available here in the village and I can withdraw and send money without going to the ATM at the main branch which is 5kms away. I have the option to transfer money to Mpesa and withdraw via Mpesa agent or pay for transactions which are only possible via mpesa. The main challenge of banking agent is you still must go to the bank in person to apply for the loan and wait a few days to be processed. Unfortunately, with Equity you must go to the bank in person to request a lone. It takes time before it is approved. You can only go to the Equity agent to withdraw already approved loan.

Case Study 8.

Name: Wangari.

Age: 36.

level of education: Primary school.

Marital status: Widowed.

Number of children: 5 children.

livelihood strategies: Coffee farming and shop keeper.

Role, Life history and timeline of Using DFS.

Type of digital financial services used:

I started using Mshwari and Fuliza Mpesa in 2019. I first heard of Mpesa when Safaricom held road shows in the village. The Mpesa agents trained us how to use the services.

I use Mpesa for transaction purposes and DFS to acquire loans and saving with interest.

DFS in Food access: I receive money from relatives since my husband died.

DFS in agriculture.

Access to loans enables me to invest in agriculture to buy farm inputs such as fertilizer and pesticide.

I also took a loan on Mpesa to start my business enterprise.

Advantages of using DFS.

DFS are more convenient and affordable because I don't have to travel.

Challenges of using DFS.

High interest on loans.

Case Study 9.

Name: Nyambura

Village: Kaharo, Gikondi.

Age: 55 years old.

level of education: No formal education.

Marital Status: Polygamous marriage.

Number of children: 10 children and 4 grandchildren.

livelihood strategies: Coffee and dairy cows' farmer.

Topical history /timeline of DFS.

My children who live in the city send me money via Mpesa.

When did you start using Digital financial services:

Skills in using digital financial services: I am not literate hence I cannot use the DFS for accessing loans.

My children told me about Mpesa which was the only way for them to send money home for food. However, when they send the money I ask my grandchildren to go to the Mpesa agent and withdraw it for me. I use the digital financial services to receive money. I do not have the capacity to send.

I cannot neither read nor write English or Swahili which are the only options on the application. If there was an option for local languages and verbal instructions for people who lack the capacity to read would be helpful.

Unfortunately, in the village there are no banks or any other way to send or receive money.

DFS enable me to receive money to purchase food for my household.

Case study 10.

Name: Wairimu.

Village: Muthuthiini, Gikondi.

Age: 55 years old.

level of education: No formal education. Adult literacy classes.

Marital status: I am a Second wife. I live in my own compound with my children as per the tradition.

Number of children: I have 10 children and 6 grandchildren.

livelihood strategies: Coffee farming and basketry.

TOPICAL HISTORY /TIMELINE OF DFS.**Type of digital financial services used:**

I started using Mpesa in 2019. My children who live in the city send me money via Mpesa.

My children told me about Mpesa which was the only way for them to send money home for food. However, when they send the money I ask my grandchildren to go to the Mpesa agent and withdraw it for me. I use the digital financial services to receive money. I do not have the capacity to send.

I practice basketry which I learned from my mother. Agriculture is not a sustainable source of income due to shocks such as rainfall shortage since farming in Nyeri county is rainfed, failure of crops, low prices.

Challenges / hinderances that prevent you from using DFS services.

I cannot neither read nor write English or Swahili which are the only options on the application. If there was an option for local languages and verbal instructions for people who lack the capacity to read would be helpful.

DFS enable me to receive money to purchase food for my household. Whenever I ran out of food, I call my children and I receive the money quickly.

Table 2 : Digital financial services

DFS Application.	Timeline for use.	Purpose.
Mpesa	2019	Remittances
Mshwari	2019	Savings and Loans
Fuliza	2019	Overdraft Facility
Tala	2020	Digital Loan
Branch	2020	Digital Loan
Equity agent	2020	Withdrawing and Deposit
Eazzy banking	2020	Transactions.

Two focus group discussions of eight female farmers each assigned the code RFFFG1, RFFFG2: Rural Female Farmers Focus Group.

Key informants profile: Key informant Department of Agriculture and Food security (KIDA), Key informant Mobile Money Manager (KIMM), Key informant County Development Fund(KICDF), Key informant Rural Development (KIRD).



Figure 2: Rural farmers using Mpesa.



Source: Fieldwork, 2022.

4.2 Ways rural female farmers utilize Digital financial services to access food.

The respondents from the Case studies (SSI) and focus group Discussions were asked the question, “How do you utilize DFS to access food?” The responses from the Case studies highlighted that the respondents received remittances from family members living in urban areas via Mpesa to purchase food. They reported to receive financial support from relatives living away from home to send money for food during shortage. Other respondents took digital loans on Mshwari and Fuliza overdraft facility to complete transactions when purchasing food when their balance was deficit.

During periods of vulnerability: shocks due to income from agriculture fluctuating, drought, seasonality: increase in food prices and **hunger gaps** the rural female farmers took loans to sustain their households food consumption. Respondents drew on their savings on Mshwari which earned interest to purchase food when the household was experiencing shocks. The shocks include when the RFF had to spend huge sums of money at once: pay school fees at the beginning of the term, during illnesses or death in the family. Hence less money left for food access.

“I receive money via Mpesa from my husband who lives the city monthly to purchase food. During periods of vulnerability (seasonality) due to agricultural income fluctuation and increase in food prices, I use Fuliza overdraft facility to complete transactions at the food market when my Mpesa account balance is insufficient. This enables me to buy the amount of goods I intended to purchase instead of leaving the market without since I did not have enough money. Access to DFS enables me to sustain my households’ food consumption.”~ Mumbi

“I appeal for financial support from relatives to have sufficient money to purchase food.” Wambui.

Photo 3: The image below shows how Mpesa is used to pay for groceries using a till number.
Source: Field work, 2022.



Figure 3: Use of Mpesa in accessing food.

The information from the Case study was confirmed by the Focus group discussion.

“ We use Fuliza overdraft facility to complete transactions to purchase food.” RFFFG1.

“ We use Mpesa to receive money from family members living in Nairobi the capital city to shop for food in the market ” RFFFG1.



Photo 4: The above image shows the participants of the FGD discussing about use of DFS.

Source: Field work, 2022.

The response corresponds with the key informants' responses.

The key informant from Department of Agriculture and Food Security:

“When Rural female farmers households experience food shortage, they appeal to other family members living in the city for financial support which is sent via Mobile Money Mpesa. Rural Female Farmer’ households which receive remittances demonstrate higher capacity to access food. RFF also use Fuliza overdraft facility and quick digital loans to purchase food ” KIDA

“We provide food outlets in the local market with pay bill number/ Mpesa mobile money methods of payment to enable seamless transactions between customers and sellers. Mpesa platform has Fuliza overdraft facility which allows users to complete transactions up to a certain limit and the amount is deducted when the Mpesa account is topped up. On Mshwari, users can save, earn interest of 6.3% p.a and access digital loans ”

~ KIMM

4.3 How access to Digital Financial services affect food Consumption in rural female farmers household in Nyeri county.

The researcher asked the interviewees how access to digital Financial services affect the food consumption in their households. Households which received remittances from family members living in the city via Mpesa reported to consume diverse variety food during the period when the money was received. The households consumed all three meals a day without having to change their diet as a coping mechanism during periods of shocks.

Rural female farmers households which used Fuliza, Mshwari reported to spend the money only on the basic foods commodities necessary for survival. Access to Fuliza and Mshwari cushioned the households from going hungry. RFF using Eazzy banking and bank agent reported not effect on food consumption.

“ When I receive money from family members in the city, I purchase food items which we do not normally consume such as bread, yoghurt, fruits and other food items which are expensive to buy

often. My household is able to consume all three meals in a day without having to consume less nutritious food.” Mumbi.

“I only use Mshwari and Fuliza to take a quick digital loan during emergencies and use the money to buy only basic food commodities for survival such as flour.” Njeri.

The information from the case studies was confirmed by the Focus group discussion.

“We only take loans during emergencies to purchase basic food commodities and not to buy variety of food groups.” RFFFG2.

Key informants.

“Households which receive remittances via DFS are more likely to spend the money on purchasing diverse food types in comparison to households which do not receive the remittances. They experience less episodes of hunger and consume variety of food types”

KIDA

Food consumption score (FCS).

Food consumption score was used to determine if there was a relationship between the access to DFS and household food consumption. The FCS aimed to measure the diversity and frequency of food groups consumed over the previous seven days. The FCS assessed the capacity of a household in accessing caloric availability, food frequency and nutritional importance of different food groups. The results were interpreted based on the average FCS score. The score was interpreted and Categorised in three categories: poor, borderline, or acceptable.

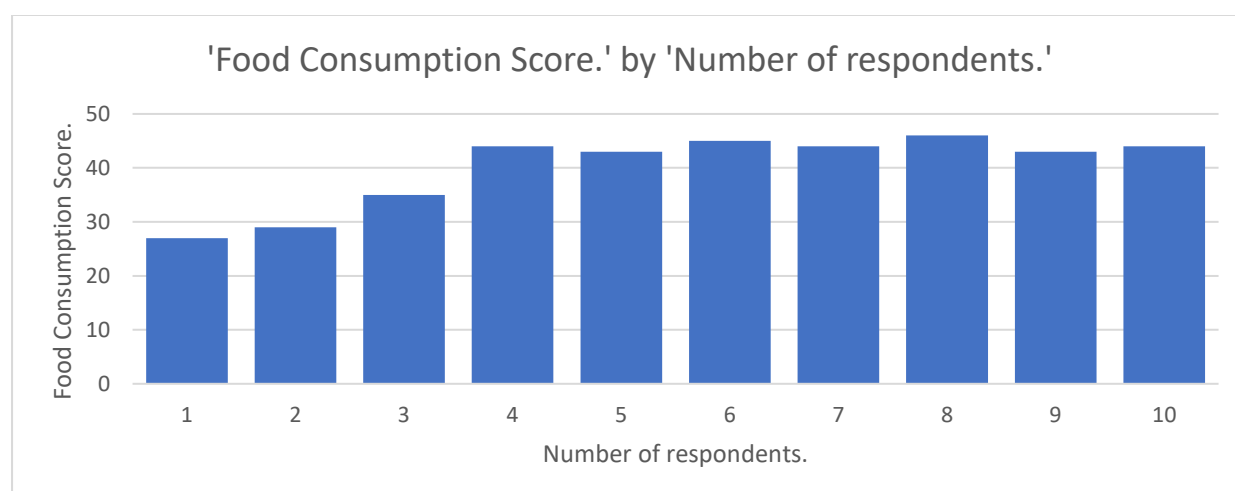


Figure 4: Food consumption score

Source: Researcher, 2022.

The result from the food consumption score represented in the figure above confirmed that there is more diverse food consumption in the households which received remittances via Mpesa. It indicated that the households had the highest scores in the acceptable category. The FCS of the households was in the acceptable category. Few were in the borderline category and poor consumption score.

4.4. Way rural female farmers use Digital financial services to improve their livelihood strategies to increase income to access food.

The researcher asked the rural female farmers how they use the digital financial services to achieve their livelihood outcome: Increased income to access food. From the responses, all 10 (100%) respondents affirmed to use digital financial services to access loans and savings. They are used to invest in agriculture to purchase quality inputs such as fertilizers and pesticides which have potential to increase yield when combined with enabling factors such as favorable climate which could contribute to increased income to access food. Physical assets and equipment such as drip irrigation and storage facility support agricultural practice. The farmers also reported to use DFS to transact payment to purchase farm inputs, pay for labour and transportation to the coffee factory via Mpesa mobile money.

The semi structured interview responses:

"I take digital loans on Mpesa to purchase farm inputs such as fertilizer, pesticide, pay for labour during harvest season, storage facility and transportation to the coffee factory. There are many factors that affect agricultural production. I would not owe it to one single factor. However, access to loans to invest in agriculture determine the level of produce. For instance, in the past when I did not have the option to access loans through Mpesa, I would have difficulty paying for unforeseen expenses in farming. Now that I can get a quick loan, immediately with no requirements: I can buy farm inputs which contribute to increased production." Mumbi

"I recently used Mpesa to get a loan to buy and plant 174 coffee Batian stems and to purchase drip irrigation." Wanjiru.

The information was validated by the focus group discussion members in the following extract:

"[.....] the use of quality inputs increases agricultural productivity of coffee leading to more income in some instances but having quality inputs does not always result to higher income" ~ RFFFGD1.

"[....] there has been an increase of agricultural production due to the use of quality farm inputs such as fertilizers but other factors have also contributed to the improvement." ~ RFFFGD2.

The key informants from Department of Agriculture also confirmed that access to DFS enable the rural female farmers to invest in quality farm inputs and physical assets which have potential to increase yield if combined with enabling factors hence possible increase in income to access food.

"DFS have revolutionized how rural female farmers engage in agriculture through access to digital loans to invest in agriculture when combined with enabling factors hence possible increase in yield and possible income to access food." ~ KIDA

"Loans given to rural female farmers are dispatched via DFS which support farming" ~ KCDF.

"Mobile money provider also confirmed that they provide farm input suppliers with pay bill number/ Mpesa mobile money methods of payment between customers." KIMM



Figure 5: Coffee farmer harvesting.

Photo 5: The image demonstrates a rural female farmer picking coffee.

Source: Fieldwork, 2022

4.5 Ways rural female farmers use Digital financial service to diversify their Livelihoods to increase income to access food.

The researcher asked the rural female farmers how they use digital financial services to diversify their Livelihoods in order to gain income to access food. The respondents use loans from DFS to engage in alternative activities such as dairy farming and non-farm activities such as basketry and hairdressing to earn income to purchase food. Supplementary income enables the households access food. Agriculture is not a sustainable source of income due to shocks such as rainfall shortage since farming in Nyeri county is rainfed, failure of crops, low prices.

“Coffee farming is not a sustainable source of income on its own to sustain my household. I recently took a loan on Mshwari to purchase a dairy cow for milk. Income from sale of milk acts as supplementary income to access food.” Mumbi.

“Coffee proceeds are paid quarterly, hence I need an alternative source of income to ensure my household has access to food before my next pay day. I use Mshwari and Fuliza to access loans to set up a business in trade the shopping centre .” Waithera.

Focus Group Discussion also affirmed the responses.

“Coffee does not perform well when mixed with other crops. Therefore we cannot plant other crops inside. The coffee branches becomes very thick to allow intercropping. I use digital loans to hire a different piece of land for my dairy cows and plant Napier grass.” RFFFGD2

“We use loan to engage in farm and non-farm activities to spread risk in case one source of livelihood fails” RFFFGD2.

Key informants from Department of Agriculture affirmed the response from the rural female farmers

“ Due to climate change, price fluctuations, coffee is not a sustainable source of income on its own. Farmers require alternative source of income to have sufficient household food access. Engaging in other livelihood strategies enable rural farmers to have sufficient income to access food. ”KIDA.

4.6 The Strength, Weakness, opportunities, and Threats of using DFS.

4.6.1 Strengths

The findings from the information given by the 10 rural female farmers in the case study revealed that using DFS enable them to acquire Instant digital loans which are cheaper than bank loans. DFS are convenient because one can make transactions and access loans at the comfort of their homes without needing to travel or file paper work to apply for loans. DFS saves time because users no longer need to take time off farming duties. Once the loan is approved its sent to instantly to the user. DFS do not require collateral, guarantor to co-sign the loan. DFS are reliable source of financing and one is not worried about being defrauded. DFS offers privacy and anonymity of to users, nobody can know when they are experiencing financial troubles.

Mpesa acts as a bank by allowing RFF to save and avoid impulse buying.

“ Mpesa is convenient because I can make transactions and access loans at the comfort of my house. I do not need to travel to the bank and apply for a loan and fill paper work. Once the loan is approved its sent to me instantly.” Wanjiru.

“Since there are no banks here in the village, Mpesa is like a bank at hand. If you have cash at hand, it is risky you end up making impulse purchases. If you deposit money on Mpesa, you remain with only the cash you require. Money is more secure on MPesa, you cannot be extravagant. You avoid buying things you had not budgeted for.” Mumbi.

These strengths were also highlighted by members of focus group discussion, which indicated the benefits of DFS in saving time and being convenient source of financing.

“We do not need to travel far get an Mpesa agent to withdraw money. In the past we used to travel to the city centre in Mukurweini 5kms away to borrow loans from lenders which is inconvenient. No transportation cost incurred. We no longer need to take time off farming duties to go to the bank anymore. It brought ease to use.” RFFFG2

In addition, the key informants from Mobile money provider also indicated other strengths found in the use of DFS

“ Users do not require you to have collateral in order to qualify for a loan or have a guarantor. Mpesa agents are available in every village” KIMM

4.6.2 Weakness

The findings from data collected indicated that DFS interest on loans, repayment period and terms are not favourable. Default on a loan repayment leads to users being put on the Credit Reference Bureau list where one is viewed as a risky borrower. There are hidden fees and charges associated with the loan that users are not fully aware of until the loan is completely processed. Having access to overdraft facility and instant loans at any time makes users engage in impulsive consumption. DFS are not user friendly to rural female farmers who are not educated. Respondents also indicated that lack of WIFI or stable internet mobile connection in the village makes it difficult to use mobile lending apps. Access to quick digital loans on DFS put Rural female farmers households into a harmful cycle of debt and bankruptcy which could be detrimental in the long run.

“The interest of repaying the loans on the mobile apps and the mobile money is high. 7.5% When I take a loan of \$100, I repay \$75. The amount increases each day you delay repaying. At times I end up paying interest as high as the loan itself. If you have a loan on Fuliza and you receive money on Mpesa, they first deduct the loan. So, if you had planned to use the money for other purposes you have to find an alternative. Defaulting on a payment you are listed in the CRB list as a risky borrower which affects your finances because other lenders check if you are on the list before receiving a future loan.” Mumbi.

“Initially when I started using DFS, it was difficult to maneuver through the platform. There are often new changes made to the platform which are difficult to keep up with. Sometimes the applications fails or its down for update for about 24 hours and during this period you cannot make or receive any transactions.” Wangui.

The weaknesses highlighted by the respondents in semi-structured interviews were also confirmed by the response from the focus group discussion. Rural female Farmers in the focus group discussion of women indicated that if they had access to bank accounts they could use equity money agent and Eazzy banking app. Others said that if they had knowledge/skills and access to the internet they would use Mobile lending apps which are done online.

“ We do not have access to stable internet to use mobile lending apps such as Tala and Branch since transactions are made online. We also lack the advanced skills required in operating mobile lending apps. We do not use Eazzy banking app and bank agent since we do not meet the requirements to qualify for a bank account” ~RFFFG1

The weaknesses indicated by the SSI participants and FGDs have also been highlighted by the key informants as indicated below:

“We have experienced challenges by scammers who call and act as our customer care demanding payments on another number and asking for pin and registration details and default our users. We have taken measures to protect our customers by sharing information on which our customer care calls on and asked users not to share any private information and that customer care do not ask for pin number. Mobile data connection in remote areas is poor due to lack of network boosters since we cannot access the areas due to poor road network. The cost of installing Wifi and monthly subscription is expensive for most rural population”~ KIMM

“Access to quick digital loans on DFS put Rural female farmers households into a harmful cycle of debt and bankruptcy which could be detrimental in the long run.” KIRD.

4.6.3 opportunities of using DFS

DFS close financial exclusion gender gap among rural female farmers who are unbanked.

DFS facilitate rural female farmers' access to loans and overdraft facility to purchase farm inputs to invest in agriculture. Quality inputs contributes to increase the yield in combination with enabling factors which result in potential increase in income to access food. Rural female farmers use loans from DFS to diversify their livelihoods in order to increase the income to access food. DFS enable the RFF to spread risk in case on source of livelihood fails.

Mpesa enables the rural female farmers to receive remittances which they use to access food. In addition, Fuliza allows the RFF to complete transactions to purchase food with insufficient balance. Mshwari allows them to earn interest on savings which is used for accessing food.

SSI participants and reports from the two focus group discussions also indicated that DFS facilitated access to loans to invest in agriculture and diversify their portfolio.

“I use Mshwari and Fuliza to access loans to set up a business in trade the shopping centre to supplement my source of income to have access to food.” Waithera.

“I use Tala and branch to access loans to start engage in nonfarm activities such as hairdressing to earn income to purchase food.” Njeri.

“We use loan from Mshwari to engage in both farm and non farm activities to have diverse income to spread the risk in case on source of livelihood fails.” RFFFGD1

Key informants from Department of Agriculture affirmed the response from the rural female farmers

“Access to DFS enable rural female farmers to receive remittances from relatives living in urban areas with support their economics access to food. Farmers require alternative source of income to have sufficient household food access. Engaging in other livelihood strategies is crucial.” KIDA.

“DFS close financial exclusion gender gap among rural female farmers who are unbanked.” KIRD.

4.6.4 Threats using DFS .

The study also found that digital illiteracy is the barrier to many farmers using DFS. In addition, only English and Swahili languages are used on the DFS which prevent women who do not understand the language from using the applications. Economic barriers prevent some rural female farmers from purchasing a smart phone because the initial cost is relatively high. Charges associated with using DFS put off rural female farmers from benefiting from the services. DFS receive resistance from older rural female farmers who do not understand why they should change how they have been accessing finance for decades to start using foreign technology.

“At first, I was skeptical because it was a new technology that I was not familiar with. Also, there were many complaints from users who lost money when they made errors entering the mobile number to send money and there was no reverse key at the time. There were scammers who called and acted as customer care demanding payments on another number and asking for pin and registration details: ID number, date of birth. I have personally received a forwarded text message where the sender claimed to have sent me money by accident and I should forward back the money. I tried to reverse but my balance was zero. That is how I found it was a scam. If I had money, I could have lost it during the reversal process.” Mumbi

“I did not receive formal education hence I cannot read or write English or Swahili hence I am unable to use the DFS apart from receiving money” Wairimu.

The focus group discussion validated the SSI findings.

“Economic barriers prevent Rural female farmers from purchasing a smart phone and high charges associated with using DFS.” RFFFGD1

The key informants from mobile money provider reported

“Older rural female farmers are not open to using DFS. They make the smallest percentage of our users. Most use merry go round women groups savings to access loans.”

KIMM

Strengths	Weaknesses
<ul style="list-style-type: none"> • DFS enable rural female farmers to acquire instant digital loans which are cheaper. • Convenient as transactions and loans accessible at the comfort of one's home without traveling or filling paper work to apply for loans. • Saves time because users no longer need to take time off farming duties. Once the loan is approved its sent to instantly to the user. • Do not require collateral, guarantor to co-sign the loan. • Reliable source of financing. • Offers privacy and anonymity of to users, nobody can know when they are experiencing financial troubles. • Enables the rural female farmers to receive remittances which they use to access food. • Fuliza allows the RFF to complete transactions to purchase food with insufficient balance. • Interest on savings • Mpesa acts as a bank at hand. 	<ul style="list-style-type: none"> • Access to quick digital loans on DFS put Rural female farmers into a harmful cycle of debt and bankruptcy. • High interest on loans. • Unfavourable repayment terms and period. • Dire consequences on repayment delay or default on loans. • Hidden charges associated with the digital loans. • Access to overdraft facility and instant loans encourage impulsive consumption. • Unsuitable for educated rural female farmers. • Lack of WIFI or stable internet mobile connection makes it difficult to use mobile lending apps.
Opportunities	Threats
<ul style="list-style-type: none"> • Close financial exclusion gender gap among rural female farmers. • Access to loans and overdraft facility to invest in agriculture. • Digital loans used to diversify RFF livelihoods in order to increase the income to access food. • Spread risk in case one source of livelihood fails. 	<ul style="list-style-type: none"> • Digital and financial illiteracy • Language and Economic barriers prevent to purchase a smart phone and Charges associated with using DFS. • resistance from older rural female farmers from using foreign technology. • Skeptical because it is new technology that users are not familiar with. • Scammers who defraud users.

Figure 6: SWOT analysis

Source: Author, 2022

CHAPTER 5: DISCUSSION OF FINDINGS

5.0 Introduction.

This chapter presents the discussion of the results and findings . The chapter also explains the researcher's role during the data collection, reflection on the research process and quality of findings. The discussion facilitated the researcher in drawing the appropriate conclusion and recommendations.

5.1 Ways rural female farmers use Digital Financial Services to access Food.

The findings from the data collected using various tools, indicated that the rural female farmers use finance obtained from DFS to purchase food. Remittances from family members living in the city are sent via Mpesa to enable households to become resilient to food shortage by having sufficient money to spend on food. Households receiving remittances reported having higher purchasing power to access diverse food types that otherwise they could not have access to . The food consumption score showed that the households experienced less episodes of hunger as most of the score was in the acceptable category. The households are more resilient to vulnerability to food inaccessibility.

The study also found that Rural female farmers' households reported to use fuliza overdraft facility to complete transactions to purchase food with a deficit balance on Mpesa . They spent digital loans on food hence an increase in the propensity to spend on consumption. Mshwari savings which earn interest were drawn upon during food emergencies. Access to Mpesa mobile money decreased the likelihood of households changing their diet or skipping meals to deal with shocks. Mpesa cushioned the households from experiencing episodes of hunger.

The findings were validated by a study conducted by Suri and Jack 2016 , which found that Mobile money cushion households from food inaccessibility and reduce episodes of hunger by smoothing consumption through savings . Accessing money through Mobile money acts as a coping mechanism to deal with shocks and for consumption smoothing (Blumenstock, et al 2016). A study in Ghana by Sakyi-Nyarko in 2022 Investigating the implications of mobile money access on household welfare, also showed resilience to shocks and outcome in food consumption.

The findings were consistent with a study in Uganda which found similar effect of mobile money reducing the percentage of households with low food access in areas without banks (Wieser, 2019). Bharadwaj (2019) indicates that digital loans in Kenya improve household resilience: households are 6.3 percentage points less likely to forego food expenses due to negative shocks. Access to credit for consumption smoothing is important in developing countries where income is subject to shocks, few social safety nets and other financial substitutes are negligible, and where the outcomes of income fluctuations are severe.

5.2. Ways rural female farmers use Digital Financial Service to improve their strategies: to increase agricultural production hence income to access food.

The findings from responses from the rural female farmers indicated that Mpesa, Tala and Branch are used to access digital loans to invest in agriculture. Loans are used to purchase farm inputs such as fertilizers, pesticides, equipment such as drip irrigation storage facility and transportation to the coffee factory.

Quality inputs have potential to contribute to improved yield. However, there was no evidence of positive relationship between investments in agriculture and output. In addition, high output does not automatically lead to high income to purchase food . Price fluctuation of coffee could affect the price

of yield. Hence, taking a loan of DFS to invest in agriculture could be a risky investment with no positive outcome.

DFS act as a buffer against shocks such as climate change.

The findings aligned with a study on Financial service providers can support growing livelihoods in rural areas to improve women's outcomes and their efforts and earn most of their income from agricultural work (Reed et al 2015). Confirmed by ibid et al (2016) on access to finance improves rural women's livelihoods and deal with shocks. Brune et al (2015) stated that DFS increased investment which boost crop output. According to FAO (2015), access to credit enable farmers to make investments that could increase crop yield. Findings supported by a study by (Afawubo, et al 2019) in Togo concluded that mobile money users are less vulnerable to economic shocks such as rain shortage and high prices of agricultural inputs. Mobile money acts as a buffer against risks and builds resilience (Hendriks, 2019.) Mobile money is increasingly promoted as a strategy to improve financial outcomes and livelihoods in low-income countries (Chiwaula, et al 2020).

5.3 How access to DFS enable rural female farmers to diversify their portfolio: to increase income hence to access food.

Findings from the respondents indicated that RFF use loans from DFS to engage in alternative activities such as dairy farming and non farm activities to earn income to purchase food. Agriculture is not a sustainable source of income due to shocks as rainfall shortage since farming in Nyeri county is rainfed, failure of crops and price fluctuations. DFS enable rural female farmers to spread risk and become resilient when agriculture fails due to shocks such as climate change. The findings from RFF who engaged in more than one income generated activity indicated high consumption of various food commodities.

The above findings were also supported by FAO (2015) which stated that financial services help female farmers increase their income security, which can lead to better household nutrition.

A study in Uganda found that mobile money can improve livelihoods even in poor and remote settings (Wieser, 2019).

5.4 Strengths, Weaknesses, Opportunities and Threats in using DFS.

5.4.1 Strengths of using DFS.

The study found the following strengths in to the use of DFS by rural female farmers:

- DFS enable the rural female farmers to acquire Instant digital loans, overdraft facility which are cheaper in comparison to traditional bank loans.
- DFS enable the farmers to make transactions, save money, save their time.
- Risk sharing through mobile money transactions between household members experiencing shocks.
- No collateral, guarantor or filing paperwork required to access the loan.
- DFS enables financial inclusion of rural women.

DFS promote financial inclusion by granting smallholder farmers access to digital financial services.(Sam,2021). Digital financial services benefit rural women of having a savings account Bridging the financial inclusion gender gap in smallholder agriculture in Nigeria: An untapped potential for sustainable development (Adegbite, 2020).

5.4.2 Weaknesses of using DFS in agriculture for food accessibility .

The weaknesses associated with use of include the following:

- Interest on Digital loans, repayment period and terms are not favourable.

- Default on a loan repayment leads to users being put on the Credit Reference Bureau list where one is viewed as a risky borrower.
- Hidden fees and charges associated with the loan that users are not aware of until the loan is completely processed.
- Access to overdraft facility and instant loans at any time encourage users to engage in impulsive consumption.
- DFS are not user friendly to rural female farmers who are illiterate. The services use only English and Swahili which the farmers do not understand. Language barrier is overlooked by DFS providers who assume all users are multilingual.
- Respondents indicated that lack of WIFI or stable internet mobile connection in the village makes it difficult to use mobile lending apps.

These weaknesses of DFS are connected to what was highlighted by Kusuma (2022) exploring the technical aspect of using the digital financial services prevent ease in use and adoption among rural women. Women dominate the informal employment sector where income is small and irregular hence limited financial capacity to purchase smart phones, pay for transaction fees affect women when accessing DFS (Ouma, 2017).

Comparing the benefits and drawbacks of DFS, the researcher commented that only RFF who are literate and multilingual who reap the benefits. Illiterate RFF are still left unbanked and the benefits of DFS do not trickle down to them.

Shocks such as climate change / unforeseen circumstances overshadow the effects of DFS. Climate changes which neutralise the benefits of DFS in increasing the yield.

5.4 .3 Opportunities of using DFS.

The study found that using DFS has the following opportunities:

DFS close financial exclusion gender gap among rural female farmers. Access to loans and overdraft facility to purchase farm inputs to invest in agriculture which contributes to increase the yield and potential higher income to access food. During hunger, cash transfers can be sent via mobile money to the rural female farmers. DFS cushion households from shocks by ensuring consumption smoothing through remittances.

These opportunities revealed by the research confirmed that using mobile money enhance the ability to deal with shocks, consumption smoothing after a shock Riley (2018).

A study exploring fintech solutions for women indicate that low cost digital financial services (DFS) such as mobile money to close gender gaps in financial exclusion. (Analytics, 2018.) DFS offers an opportunity to close the gender gap in financial inclusion of women farmer's and contribute to 16% agriculture productivity gaps between men and women farmers (Mndolwa, 2017.)

The researcher's comment on the strengths revealed was that DFS are beneficial to rural female farmers in diversifying their portfolio and building the households resilience to access food during shocks.

5.4.4 Threats of using DFS.

The study identified various threats associated with the use of dfs:

Digital and financial illiteracy among rural female farmers due to low level of education pose challenges in operation the smart phones and using DFS. Language barrier since the DFS are programmed in English and Swahili while some of the women only understand ethnic languages. Some farmers have limited financial capacity to own a smart phone.

Although digital finance has led to financial inclusion of rural female farmers households , it has also increased the risk of the households being trapped into debt . Ease in accessing quick digital loans without requirements such as collateral could trap a household into a dangerous cycle of permanent debt .

The findings were supported by a study by Yue et al , (2022) on digital finance as a double edged sword through financial inclusion and debt trap. The study found that DFS increased the risk of the households being trapped into debt. Opati, (2022) found that digital loans trapped customer base in the debt trap, inflated pricing model, high interest rates, and short-term loan tenures.

In spite of the threats identified by the findings, the respondents in the study indicated that the opportunities outweigh the threats.

5.4 Reflection on the researcher's role in the study.

5.4.1 Research process and methodology.

The research aimed to explore the role of digital financial services on food accessibility in Nyeri County. The researcher chose to conduct the study in Nyeri county because of the high rate of food inaccessibility among cash crop farmers. The research was conducted in Mukurweini subcounty, Nyeri. The region has highest percentage of DFS penetration hence the researcher was confident in getting the required information. Explaining the goal of the research to the participant made them feel the value of their contribution towards the research in order to find a solution for food accessibility together.

It was difficult to coordinate all the activities because I was solely involved in planning and conducting the entire research process. I realized the need for a research plan and importance of leaving room for flexibility. Before starting the fieldwork I came up with a research plan to guide

My data collection process. The guide in form of a schedule had dates on when certain activities would be completed: reaching out to interviewees, setting up interviews to avoid double booking.

When going for the fieldwork, the researcher had doubts about getting reliable information due to the nature of the research which would be asking private information on house hold finance which is a taboo topic in the Kikuyu culture. Questions on food consumption to calculate the score within the household was uncomfortable interview to have. The researcher was worried that the respondents would withhold information that would portray them to be struggling financially. There is stigma in having loans which is viewed as a sign of poverty which could lead to social exclusion. People are not open to discuss about money matters candidly. Asking the respondents about the food they ate was intrusive.

The researcher was surprised by the fact that the people she was in touch with prior to the fieldwork , who would participate in the interview dropped off unexpectedly. The researcher resulted in interviewing new people hence I had to change my sample. I also changed my sampling method to Convenience and Snowball sampling to select the respondents. The researcher focused on qualitative data to get in depth information, opinions and experiences from rural female farmers on the use of DFS and how they contribute to food accessibility.

5.4.2 The quality of Research findings.

To ensure the credibility and validity of research findings, the researcher used triangulation through semi structured interviews, focus group discussions with the rural female farmers and key informants. Food consumption score based on household consumption for 7 days gave a clear picture of food accessibility. The researcher hoped to interview various cash crop farmers but unfortunately

ended up with only coffee farmers. Tea farmer were occupied with harvesting hence it was impossible to book an appointment.

After data collection, the researcher translated and transcribed the data to English. Themes, patterns and categorised were identified to help answer the research questions. The data transcribed was coded and analysed using content analysis tool.

based on the findings based on the research sub questions and ranked based on consistency of the various data collection methods. . Hence the researcher drew the conclusion from the different sources to ensure the reliability and validity. The research findings from the methods used were related, consistent and few discrepancies which led the researcher's conclusion to be reliable and valid .

The surprise found in these findings were that DFS services: mobile money Mpesa had led to a cashless system of payment in the village. The women reported to make transactions through till and pay bill numbers. It is cheaper than withdrawing the cash. DFS are also used to pay for labour.

Potential influence of own researcher position and ideas on results obtained.

The researcher received a lot of willing participants since there were benefits in participating. Therefore it was hard to narrow down to 10 farmers and they could have been bias selecting the few chosen. By the virtue of the researcher revealing to be a masters student in Europe, could have caused a power difference which altered the information disclosed by the interviewees. Since the information would be shared with people abroad. The researcher felt that some households were not forthcoming about their financial practices using DFS and on food groups they consumed. Consuming certain food types is associated with households being low class /poor which is embarrassing. Some households could have given inaccurate information to appear well off than they are to hide their shame in not affording certain food groups and financial practices which affect validity of the data. The researcher accidentally formatted the recording device and lost the first few interviews. Although the farmers were kind enough to meet me again, crucial information might have been lost. Research exhaustion due to travelling for long hours to interview the respondents could have affected the results.

limitations and influencing factors beyond researchers influence.

The research coincided with political campaign period in Kenya and the researcher was wary of holding focus group discussions which would be viewed as a political statement.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion.

The research was conducted to explore the role of digital financial services in enabling rural female farmers' households access food in Nyeri county. The study used a case study to assess the strengths, weaknesses, opportunities and threats of the digital financial services. The results analysed the key variables that the research sub question sought to answer.

The findings from the interviews conducted with rural female farmers, FGDs and key informants found that they use Mpesa mobile money : Mshwari and Fuliza overdraft facility, Mobile lending apps Tala and Branch . Bank agents and mobile banking apps: Eazzy banking are also used. Mpesa mobile money is used to access digital loans, save money which earns interest, send remittances and make transactions .

The digital loans are used to invest in agriculture: to purchase farm inputs such as fertilizer. Quality inputs have potential to increase agricultural production. However, there was no evidence of relationship between investments in agriculture and output. In addition, high output does not automatically lead to high income to purchase food . Price fluctuation of coffee could affect the price of yield. Hence, taking a loan of DFS to invest in agriculture could be a risky investment with no positive outcome.

Rural female farmers use finance obtained from DFS to purchase food. Households experiencing food shortage due to shocks: climate change, illnesses death, seasonality : increased food prices and hunger gaps use DFS to access food. Fuliza overdraft facility is used to complete transactions to purchase food with a deficit balance on Mpesa. Mshwari savings which earn interest are drawn upon during food emergencies.

Remittances from family members living in the city are sent via Mpesa to enable households to become resilient to food shortage by having sufficient money to spend on food. Spending the loan on food hence an increase in the propensity to spend on food. Households with access to remittances reported having higher purchasing power to access diverse food types that otherwise they could not have access to . Access to mobile money decreased the likelihood of households changing their diet or skip meals to deal with shocks The food consumption score showed that the households experience less episodes of hunger as most of the score was above borderline. World Food Program FCS was used to assess food consumption score within 7 days which was in the acceptable category.

Access to loans on DFS enabled rural female farmers to diversify their portfolio and engage in nonfarm activities . This enables them to spread risk and become resilient when agriculture fails due to shocks such as climate change. Households are able to earn extra income to supplement income from agriculture. Hence economic access to food. Rural Female Farmers households which engaged in more than one income generated activity indicated high consumption of various food commodities.

The strengths, weaknesses, opportunities, and threats of using DFS found that they have the strengths in enabling farmers access quick digital loans to invest in agriculture. They also enable users to receive remittances and make transactions to purchase food. Conversely, DFS demonstrated weaknesses and threats in illiterate farmers who reported experiencing difficulty in using them. Mobile lending apps rely on internet networks which is not affordable to the rural female farmers. Lack of economic capacity to purchase smart phones and charges associated with using DFS: high interest rate. Short loan repayment period prevent rural female farmers to use mobile lending apps.

DFS could be the missing link to rural female farmers' access to food. However, access to quick digital loans on DFS put Rural female farmers' households into a harmful cycle of debt and bankruptcy which could be detrimental in the long run. Loans are a temporary solution to the bigger issue. DFS could just be a band aid to a problem hence need for a permanent solution. It is still paradoxical whether loans obtained from DFS in the long run are beneficial or detrimental to rural female farmers' access to food. In case the RFF are unable to repay the loans and trapped in to a cycle of debt.

DFS services: mobile money Mpesa has led to a cashless system of payment in the village. The Rural female farmers make transactions through till and pay bill numbers on their mobile applications. It is cheaper than withdrawing the cash. DFS are also used to pay for labour.

6.2 Recommendations

The objective of this study was to gain insights on the contribution of Digital Financial services to rural female farmers' access to financial asset to access food in Nyeri County, Kenya using the case study. It considered the period of 4 years from 2019, when farmers started accessing loans on DFS up to 2022. The study was conducted to explore the strengths, weaknesses, opportunities, and threats of using digital financial services in agriculture and food accessibility and to give recommendations that will help Nyeri County to assist in designing interventions to reduce hunger in the region.

Recommendation to Nyeri county.

The researcher recommends the commissioner to use gender lens and disaggregated data to ensure gender mainstreaming to implement the National Food and Nutrition Security five-year plan. This will also support interventions geared towards ensuring food accessibility among the rural female farmers. It will assist in designing interventions to reduce hunger in the region.

Collaboration by partnering with DFS providers to ensure digital and financial literacy of rural female farmers to ensure they have the proper skills required to use the apps. Financial literacy will enable the RFF to avoid being trapped in debt by taking loans which might be difficult to repay.

In addition, the county should support access to stable and affordable internet connection in the village. Provision of stable mobile data and internet connections will ensure access to mobile lending apps.

DFS regulation on the interest charged on loans to ensure affordability since farmers rely on DFS because they are unbanked. The county government should support use of DFS by giving tax breaks to DFS providers to ensure all rural female farmers have access to them. Alternatively, the county government should provide loans to Rural Female farmers with zero interest to invest in agriculture.

Recommendation to rural female farmers

My recommendation to farmers should be to embrace the use of DFS to receive remittances, make transactions and access loans to invest in farming and food access. They should only borrow loans they can afford to repay in a certain time frame when they really need them to avoid being trapped into debt. For instance, only use DFS loans for investment as opposed to consumption.

DFS Providers.

The researcher recommends the DFS providers to come up with services customized to meet rural female farmer's needs. For instance incorporate local languages in the apps, have voice option for users who are illiterate.

To offer affordable charges and favourable loan repayment period to the rural female farmers who use the DFS under a certain income bracket.

Area for further research.

Research on the relationships between use digital financial services and food security among rural female farmers is a new phenomenon. DFS have only started being used in the past few years in SubSahara Africa. DFS could be the missing puzzle to solve food insecurity in the region since most people are unbaked with limited access to financial asset. However, DFS have potential to trap rural female farmers in cycle of debt. Hence, the researcher would like to suggest further research to be carried out to explore long run effects of DFS on rural female farmers' livelihood outcomes: food security and agricultural production and income. Are DFS services sustainable in the long run? Are they actually beneficial or detrimental to farmers? In case farmers are unable to pay the loans and trapped in to a cycle of debt? Loans are a temporary solution to the bigger issue. DFS could just be a band aid on on a problem, hence need for a permanent solution.

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APPENDICES.

Source: Author, 2022.

Semi-structured interview Topics for Case Study.

I am Kahara Purity, a master's student in Management of Development- Food Nutrition and Security at Van Hall Larenstein University of applied sciences, Netherlands. I am conducting this research to complete my thesis on the contribution of digital financial services in food accessibility among rural female farmers : a case study of Nyeri county, Kenya.

I would like to kindly ask for your support in responding to the following questions in order for me to collect data on the role of digital financial services in food access and formulate recommendations to Nyeri county government for interventions. I will appreciate your participation. Strict code of ethics will be adhered to during the research. It is voluntary to take part in the research and permission to stop at any time. Confidentiality will be assured of identity or information that would be traced back to the interviewees. The interview will not exceed one hour.

PROFILE OF RESPONDENT.

1. Name Contact..... Village

2. Age of respondent:

- a) 18-25 ☐ b) 26-35 ☐ c) 36-45 ☐ d) 46-55 ☐

d)above 55

3.Level of education of respondent:

a) University Graduate

☐

b) High school

☐

c) Primary Education

☐

d) No education

☐

4. What is your marital status?

5. . How many members does your household consist of (number of children)?

6.Who is the breadwinner for your family ?

7. Who has rights and ownership of the assets you use in farming (land, physical, financial capital)?

TOPICS.

1. History/ Timeline when the rural female farmers started using Digital financial services reason for use, negative and positive changes. Evolution of use and trends.
2. The types of Digital financial services used by rural female farmers and why the choice.

Digital Financial Inclusion of rural female farmers.

Information on the Knowledge and skills in use of Digital financial service.

The role of Digital financial services in Agriculture. Purpose of funds obtained from DFS in farming

3. The role of Digital financial services on household capacity to access Food.
4. Challenges and benefits of using DFS among rural female farmers.
5. Perception of the use of Digital Financial Services: features or tools, experience using DFS.
6. Household dynamics: key decision maker, allocation of resources and division of labour in the household.
7. Household food access budget.
8. Food security status using World Food Programme Food Consumption Score (FCS)

FOCUS GROUP DISCUSSION .

1. Use of Digital financial services in agriculture and reasons.
2. use Digital financial services to ensure household food accessibility.
3. Sustainability of agriculture as a source of livelihood.
4. Challenges of using DFS services.
5. Food accessibility among rural female farmers.
6. Coping mechanism during food shortage in the households.

THE KEY INFORMANTS INTERVIEW GUIDE.:

GOVERNMENT OFFICIALS.

Position and Department.

1. Government programs on financial inclusion of rural female farmers .
2. Efforts to support rural female farmers access digital financial services .
3. Regulation of DFS providers.
4. Collaborate with digital financial service providers to meet need of rural female farmers financial needs.
5. Governments role in pricing agricultural products .
6. Governments role in supporting rural female farmers to access food .
7. Regulations on food prices.
8. Food assistance to households experiencing hunger.
9. Situation of food access level among Nyeri residents in agriculture.
10. Digital literacy training programs to improve rural female farmers skills and capabilities in using DFS.
11. Government programs or policies designed to support women's economic participation.

DFS PROVIDERS: MOBILE MONEY MANAGER.

1. Customized services for rural female farmers to access financial services . Launch of DFS that can be used by illiterate rural women.
2. Digital literacy training for rural female farmers use of DFS.
3. Partnerships with the government /organization to support rural female farmers in agricultural production.
4. Sex- disaggregated data on use of DFS among rural women farmers .
5. Plan to reduce the transaction costs to make DFS affordable for rural female farmers.

PHOTO ELICITATION CHECKLIST.

1. Photos of Female Farmers in the field operating Digital financial services.
2. Pictures of Female Farmers using Digital financial services for different purposes .
3. Training sessions of women learning how to use DFS services.
4. Digital Financial providing Services to the rural female farmers.
5. Showcase Food available in the local market.

WFP' Food Consumption Score

9.1 Food consumption data collection module

The following table presents an EXAMPLE of the Food Consumption module, which should be adapted to each context.

The question should be phrased like the following¹⁰:

*I would like to ask you about all the different foods that your household members have eaten in the **last 7 days**. Could you please tell me **how many days** in the past week your household has eaten the following foods?*

(for each food, ask what the primary source of each food item eaten that week was, as well as the second main source of food, if any)

Food item	DAYS eaten in past week (0-7 days)	Sources of food (see codes below)	
		primary	secondary
#.1 - Maize			
#.2 - Rice			
#.3 - Bread/wheat			
#.4 - Tubers			
#.5 - Groundnuts & Pulses			
#.6 - Fish (eaten as a main food)			
#.7 - Fish powder (used for flavor only)			
#.8 - Red meat (sheep/goat/beef)			
#.9 - White meat (poultry)			
#.10 - Vegetable oil, fats			
#.11 - Eggs			
#.12 - Milk and dairy products (main food)			
#.13 - Milk in tea in small amounts			
#.14 - Vegetables (including leaves)			
#.15 - Fruits			
#.16 - Sweets, sugar			

Food source codes:

Purchase =1	Own production =2	Traded goods/services, barter =3
Borrowed = 4	Received as gift= 5	Food aid =6
Other (specify) =7		

Figure 7: WFP Food Consumption score.

These are the standard Food Groups and current standard weights⁵ used in all analyses. The food items listed are an example from the ODJ region.

	FOOD ITEMS (<i>examples</i>)	Food groups (definitive)	Weight (definitive)
1	Maize , maize porridge, rice, sorghum, millet pasta, bread and other cereals	Main staples	2
	Cassava, potatoes and sweet potatoes, other tubers, plantains		
2	Beans, Peas, groundnuts and cashew nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruit	1
5	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
6	Milk yogurt and other dairy	Milk	4
7	Sugar and sugar products, honey	Sugar	0.5
8	Oils, fats and butter	Oil	0.5
9	spices, tea, coffee, salt, fish power, small amounts of milk for tea.	Condiments	0