Addis Ababa University

College of Business and Economics

School of Commerce

The Role and Impact of Digital Financial Services (DFS) in Advancing Financial Inclusion in Ethiopia

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A Thesis Submitted to the Department of Business Administration and Information Systems in Partial Fulfillment of the Requirements for the Degree of *Master of Business Information Systems (MBIS)*

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Addis Ababa, Ethiopia

June, 2026

DECLARATION

I, Daniel Derese, declare that this thesis entitled “The Role and Impact of Digital Financial Services (DFS) in Advancing Financial Inclusion in Ethiopia” is my original work. I declare that the paper is not submitted for any degree, diploma, or certificate at any other University or Institution. In this paper, I have taken care to acknowledge and cite all sources used in accordance with academic standards.

This thesis is prepared under the direct supervision of my academic adviser and complies with the academic regulations of Addis Ababa University.

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APPROVAL PAGE

This is a thesis named “The Role and Impact of Digital Financial Services (DFS) in Advancing Financial Inclusion in Ethiopia,” Prepared By Daniel Derese. Addis Ababa University College of Business and Economics School of Commerce A thesis submitted in partial fulfillment of the requirements for the degree of Master of Business Information Systems (MBIS)

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ACKNOWLEDGMENT

First and foremost, I would want to thank the Almighty God for His grace and guidance during this academic journey. By these blessings this task was made possible.

I would like to extend my sincere appreciation to my advisor, Dr. Eyob Nigussie, for his continual support, illuminating comments and perpetual encouragement during the course of this study. His help and guidance were vital in setting the path of our research.

I am also sincerely grateful to the management and personnel of National Bank of Ethiopia for their institutional support and collaboration. The willingness to share perspectives and access to data on Digital Financial Services (DFS) was critical to situate our study in the ecosystem of finance in Ethiopia.

I would want to congratulate the School of Commerce, Addis Ababa University and the College of Business and Economics for creating a favorable academic environment. The master of business information systems program and its content and the intellectual stimulation I received helped me sharpen my analytical skills and expand my academic horizons.

I would like to thank the researchers and scholars whose work has been the foundation of my thesis. This analysis was focused on contributions to digital finance and financial inclusion.

And finally, I most grateful to my family and friends. Their tolerance, support and persistent belief provided me the strength and determination to accomplish this mission.

ABSTRACT

Financial inclusion—access to affordable formal financial services—is a key driver of poverty reduction and inclusive growth. In Ethiopia, Digital Financial Services (DFS) have grown rapidly since 2020, especially after regulatory reforms and the launch of Telebirr. This study examines six DFS channels (ATMs, POS, mobile banking, internet banking, agent banking, mobile money) and their impact on financial inclusion between 2020 and 2025

Using official UN population data (mid-2025 total: 135.47 million; adult 15-64: 78.5 million) and regional shares from the Ethiopian Statistical Service (ESS, 2024), the Sarma Index of Financial Inclusion (IFI) – Euclidean distance formula – suggests the national IFI increased from 0.087 (Low) in 2020 to 0.663 (High) in 2025, a 6.6-fold increase. Regional differences are substantial with Harari leading (0.748 Very High) while Oromia is the lowest (0.081 Low) followed by Amhara (0.092) and Central Ethiopia (0.193). , Low). Combined, agent banking and mobile money are the biggest drivers of IFI progress, accounting for 43%. The IFI is a good predictor of active usage ($\beta = 56.38$, $p < .001$, $R2 = .722$). However, 60% of mobile money accounts are dormant and women are substantially less included (male IFI 0.718 vs female 0.452). Scenario simulations show that the national IFI would increase to 0.75 by 2028 with active adult inclusion at 62% with full policy optimization.

The study indicates that although DFS has greatly extended access, the next phase must focus on activating dormant accounts, reducing the gender gap and reaching lagging regions. Evidence-based, channel-specific suggestions are presented for regulators, financial institutions and development partners.

Keywords: DFS, Financial Inclusion, Sarma IFI, Ethiopia, Mobile Money, Agent Banking, Gender Gap, Regional Disparities

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LIST OF ABBREVIATIONS

Abbreviation	Full Meaning
ABO	Agent Banking Outlets
AFI	Alliance for Financial Inclusion
ATM	Automated Teller Machine
CAGR	Compound Annual Growth Rate
DFS	Digital Financial Services
DPT	Digital Payment Transactions
ESS	Ethiopian Statistical Service
ETB	Ethiopian Birr
FI	Financial Inclusion
FPR	Female Participation Ratio
G2P	Government-to-Person
GSMA	Global System for Mobile Communications Association
HDI	Human Development Index
IB	Internet Banking
IDT	Innovation Diffusion Theory
IFI	Index of Financial Inclusion
IMF	International Monetary Fund
ITU	International Telecommunications Union
KMO	Kaiser-Meyer-Olkin
KYC	Know Your Customer
MB	Mobile Banking
MBIS	Master of Business Information Systems
MFI	Microfinance Institution
MM	Mobile Money
MMA	Mobile Money Accounts
NBE	National Bank of Ethiopia
NDPS	National Digital Payments Strategy
NFIS	National Financial Inclusion Strategy
OLS	Ordinary Least Squares
P2P	Person-to-Person
PCA	Principal Component Analysis
PII	Payment Instrument Issuer
POS	Point of Sale

PSNP	Productive Safety Net Programme
RBI	Reserve Bank of India
SD	Standard Deviation
SDG	Sustainable Development Goal
SWEPR	South West Ethiopian People Region
TAM	Technology Acceptance Model
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variance Inflation Factor

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

1.1.1 Global Context

Financial inclusion refers to the ability of individuals and businesses to access and use affordable financial services effectively. It is well recognized as a major driver of inclusive growth, poverty alleviation and socio-economic development (World Bank, 2022; Demirgüç-Kunt, Klapper, Singer and Ansar, 2022). Over the past decade, Digital Financial Services (DFS) have become a revolutionary channel for financial inclusion notably in low-income and developing nations with limited traditional banking infrastructure. DFS comprises a multitude of digital channels such as mobile money, digital wallets, internet banking, agent banking and interoperable payment systems that address cost, distance, documentation and service barriers (GSMA, 2023; Ozili, 2018).

Financial inclusion assists households in risk management, consumption smoothing, investment in education and enterprises and improvement of general welfare and so contributes to macroeconomic stability and economic progress (Beck, Demirgüç-Kunt and Levine, 2007; Allen et al., 2016). Access to safe and cheap financial services allows people to create assets, seek investment possibilities and protect themselves from unexpected shocks. On the other hand, financial exclusion is a driver of poverty, limits economic involvement and impedes human development (Dupas & Robinson, 2013; Jack & Suri, 2014). Digital Financial Services (DFS) have revolutionized financial inclusion. They harness digital technology to leapfrog conventional limits. DFS is the digital provision of financial services using mobile phones, computers, payment cards and internet platforms (GSMA, 2023; World Bank, 2022). These include mobile money, digital wallets, agent banking, digital credit, online banking and electronic payment systems. They lower transaction costs, erase geographical obstacles and improve the convenience and efficiency of financial transactions (Donovan, 2012; GSMA, 2022).

1.1.2 African Context

Digital financial services (DFS) have revolutionized the financial business in Sub-Saharan Africa. The growth of mobile money, led by M-Pesa in Kenya, demonstrated how digital platforms may be used to deliver financial services to the unbanked (Jack & Suri, 2014; Suri & Jack, 2016). Since then, countries like Ghana, Tanzania, and Rwanda have seen rapid expansion in financial inclusion underpinned by DFS, supported by enabling regulation, extensive agent networks, and advances in digital infrastructure (International Monetary Fund, 2022; UNCDF, 2020; Bank of Ghana, 2022). Africa accounted for 70% of the worldwide mobile money transactions in 2021, highlighting its key position in digital finance (GSMA, 2022).

One of the most well-known success stories and a focus of global study attention is Kenya's M-Pesa, which was established in 2007. M-Pesa managed in under ten years to raise financial access from 26% to more than 83% of adults, indicating that mobile money can be useful for people who are not accessible via traditional banks (Jack & Suri, 2014). Studies estimate that M-Pesa helped raise about 194,000 households out of extreme poverty, with the most benefits for female-headed households (Suri & Jack, 2016).

1.1.3 Ethiopian Context

Ethiopia has traditionally been behind the curve on the adoption of DFS because of a limited telecom sector, undeveloped digital payments systems and nascent laws. Before 2020, financial access was largely branch based, with little mobile banking and no mobile money services (National Bank of Ethiopia, 2021a; Ahmed, 2023). Banks relied on metropolitan branches while rural areas were under-banked. In 2017, just 35% of Ethiopian adults had official bank accounts, according to the worldwide Findex Database, increasing to 46% in 2021 but still below the regional and worldwide averages (Demirgüç-Kunt et al., 2022). Women, rural and low income households were disproportionately excluded. In 2017, the gender gap was 19 percentage points, a stark reminder of entrenched disparities and the need for new solutions to widen financial access.

Policy reforms such as new directives that permitted Payment Instrument Issuers (PIIs) and authorized Ethio Telecom to provide mobile money services through Telebirr in 2021 were credited for major transformations in the sector (National Bank of Ethiopia, 2021b; Ethio Telecom, 2024). The revisions represented an important milestone in Ethiopia's digital financial services (DFS) industry. "Competition in the market has increased with the launch of Telebirr and the entry of Safaricom Ethiopia and others and this has encouraged innovation,".

The pace of digital finance changes has been accelerated by the implementation of the National Financial Inclusion Strategy II (NFIS II, 2021–2025) and the National Digital Payments Strategy (NDPS, 2021–2024). NFIS II seeks to substantially promote financial inclusion targeting women, youth, rural communities and microenterprises. The target is to achieve 70% financial inclusion by 2025 with DFS at the core (National Bank of Ethiopia, 2021a). The strategy has five main focus areas: Increasing access to financial services Promoting the use of digital financial services Improving consumer protections Raising financial literacy Improving data and monitoring systems.

The National Digital Payment Strategy aims at increasing digital payments, improving the efficiency of the system, and moving towards a cash-lite economy (National Bank of Ethiopia, 2021b). The focus is on six pillars, which include constructing interoperable digital infrastructure, reaching all Ethiopians, expanding adoption, improving capacity, building trust and enabling innovation. All of these are aligned to the DFS elements of this study. The Digital Ethiopia 2025 Strategy is consolidating these efforts by focusing on financial services for digital transformation. It aims at expanding financial inclusion, improving services and

inclusive development and recognizing digital financial services as a driver for economic digitalization (Ministry of Innovation and Technology, 2023).

Despite progress, DFS usage remains low, particularly for savings, credit, insurance and merchant payments. Many Ethiopians, especially those in rural communities, women and low-income households, are unable to fully benefit from digital financial services due to structural impediments (UNCDF, 2023; GSMA, 2023). Such discrepancies cast doubts on the efficiency of DFS in attaining genuine financial inclusion.

1.2 Statement of the Problem

Despite sustained legislative and regulatory efforts, Ethiopia's financial inclusion has lagged behind the continental average, restricting economic participation for many, notably women, rural residents and low-income workers. According to the 2021 Global Findex Database, just 46% of Ethiopian people hold a formal bank account and there are persisting geographical and gender discrepancies (World Bank, 2021). Digital Financial Services (DFS), especially mobile money and agent banking, play a vital role in promoting inclusive finance by overcoming physical, cost and information barriers (Suri & Jack, 2016; GSMA, 2022). But three significant, empirically verifiable gaps remain, notwithstanding the tremendous rise of DFS from 2020 to 2025 (mobile money accounts grew from 8 million to 136 million, a 17-fold increase).

First, there is a channel-specific impact gap**:** While six DFS channels (ATMs, POS, mobile banking, internet banking, agent banking, mobile money) are available, their relative contributions to financial inclusion are unknown. Policymakers lack evidence on which channels yield the highest returns for investment.

Second, an access-usage gap: Digital account ownership has increased, but DFS use is still limited, mostly to simple transactions and underutilized value-added services. Digital activities are mostly basic in nature, including purchases of airtime and P2P transfers, with minimal take-up of digital savings, credit, insurance and merchant payments (National Bank of Ethiopia, 2023b; UNCDF, 2023). This means that the expansion of DFS doesn't really boost financial inclusion, but rather increases nominal access.

Third, a Gender Disparities: Women encounter greater hurdles in accessing DFS. "Ethiopian women are 25% less likely to own a mobile phone or access DFS" (Kebede and Alemu, 2021). Security and Trust Concerns: Cyber fraud, identity theft and data breaches have eroded the public trust, with many users becoming wary due to scams or perceptions of poor grievance resolution (Abate, Tufa, and Kassa, 2022).

Fourth, regional inequality gap: The data demonstrate that there are significant gaps in the distribution of infrastructure. Addis Ababa alone accounts for 41.5% of all ATMs and 65.8% of all POS terminals, for example, while regions such as Afar and Somali have less than 2 ATMs per 100,000 persons (NBE, 2025). Previous research have reported lower financial inclusion levels in pastoralist areas (Gemechu & Fufa, 2023).

Many structural and institutional obstacles still restrict the inclusive impact of DFS: Infrastructure Constraints: Inadequate mobile network coverage and unreliable power supply in many rural locations can be a limitation to the implementation and reliability of DFS platforms (National Bank of Ethiopia, 2023a).

The digital literacy gap. A major obstacle is a high level of digital and financial literacy. Many Ethiopians, especially the elderly, those in rural areas, and women, are unable to operate mobile applications or comprehend the aspects of digital financial goods (Tadesse & Abate, 2022). Sixty-six percent of women and sixty percent of men lack mobile money capabilities (National Bank of Ethiopia, 2024).

Regulatory and Institutional Barriers: Licensing processes for fintech companies are sometimes cumbersome and interoperability between service providers is still limited, pushing users to operate in closed networks (World Bank, 2023). KYC (Know Your Customer) rules are necessary for security, but they are exclusionary when inflexibly enforced on those without official identification.

Agent Network Constraints: The distribution of DFS agents is significantly skewed, with a significant number of DFS agents present in Addis Ababa and major towns, and a large number of rural kebeles not having any DFS agents (Ethio Telecom, 2024).

In light of the fast shifting legal and technical landscape in Ethiopia, it is crucial to do rigorous empirical analysis using recent national-level (2020-2025) and Cross-sectional data to precisely gauge the impact of DFS on financial inclusion. This study directly tackles this gap, offering evidence-based insights to policymakers, regulators and stakeholders in the financial sector to help in designing more inclusive, resilient and effective digital financial ecosystems consistent with Ethiopia's growth and reform strategy.

1.3 Research Questions

The following research questions are addressed in this study:

1.3.1 General Research Question

What is the role and impact of Digital Financial Services (DFS) on financial inclusion in Ethiopia?

1.3.2 Specific Research Questions

1. How has the adoption and growth of Digital Financial Services (DFS) evolved in Ethiopia between 2020 and 2025?

2. What is the impact of DFS access, usage, and service quality on financial inclusion outcomes across different demographic groups?

3. What are the main barriers and challenges that limit the adoption and effective use of DFS, particularly among rural communities and women?

4. To what extent do current DFS developments align with national financial inclusion objectives and targets, and how can they be optimized to achieve broader financial access?

1.4 Research Objectives

1.4.1 General Objective

This study examines the role and impact of Digital Financial Services (DFS) on financial inclusion in Ethiopia, focusing on how these services drive increased access, usage, and equity in financial participation across demographic groups.

1.4.2 Specific Objectives

1. To assess the trends, growth, and adoption patterns of DFS in Ethiopia from 2020 to 2025

2. To analyze the impact of DFS accessibility, usage frequency, and service quality on financial inclusion outcomes

3. To identify barriers and challenges to DFS adoption, with particular emphasis on rural populations, women, and other underserved groups

4. To evaluate how current DFS initiatives align with broader national financial inclusion goals and strategies

5. To provide evidence-based policy recommendations aimed at strengthening the contribution of DFS to inclusive financial development in Ethiopia

1.5 Significance of the Study

The importance of this work is multifold, with implications at academic, policy, institutional and practical levels.

Academic Significance

This study makes several important additions to the academic literature:

- This paper provides empirical evidence on digital financial services (DFS) and financial inclusion in Ethiopia using trend data from 2020-2025 and official cross-section data from the National Bank of Ethiopia as of June 30, 2025. This approach fills a gap in the literature, as there has been little study on the link between DFS expansion and financial inclusion outcomes using large regulatory data.

- It serves as a benchmark for future study on DFS and financial inclusion in Ethiopia and will be valuable for both longitudinal and comparative researchers. It points out the areas which need to be studied further and acts as a basis for future research.

Policy Significance

The findings will help the policy makers and regulators especially National Bank of Ethiopia in many ways:

- contributes evidence on the success of DFS in advancing financial inclusion to guide policy objectives and budget allocation. It highlights the biggest impact of inclusion of the DFS channels like mobile money, agent banking and digital payments.
- identifies bottlenecks that hinder the effectiveness of DFS and highlights potential for policy intervention. Priority Policy Action Areas include digital literacy, infrastructure, trust and gender restrictions.
- assesses if DFS growth is aligned with national financial inclusion aims to inform strategy development and targeting. It measures progress towards NFIS II targets and finds gaps. The paper includes evidence-based recommendations to strengthen the regulatory environment and facilitate inclusive development of DFS.

Institutional Significance

The results of this study can be applied by financial institutions and fintech startups in a variety of ways to improve DFS products and services.

- The study identifies traits affecting the adoption and usage of DFS, enabling providers to create products that are more aligned with consumer needs. Understanding consumer preferences and barriers might help inform product development.
- Second, the study highlights impediments to DFS success and allows providers to develop methods to overcome these obstacles. Findings on digital literacy, agent networks and trust can feed into operational improvements.
- Third, findings on gender differences could impact gender-responsive product design and outreach strategies that can assist providers better serve women. Fourth, the study underlines the importance of quality dimensions such as reliability, pricing and transparency and consumer protection as a reference point for service improvements.

1.6 Scope and Delimitations

- **Geographic Scope:** This is detailed research of Ethiopia at the national level, rigorously assessing trends in DFS and financial inclusion outcomes. Geographical coverage: All 14 regional states and city administrations with special focus on the differentials between good access regions (e.g. Addis Ababa) and low access regions (e.g. Somali and Afar).

- **Temporal scope:** The time frame is 2020–2025, a period of rapid DFS expansion in Ethiopia following regulatory reforms by the National Bank of Ethiopia and the introduction of mobile money services like as Telebirr. The study uses 2 categories of data. The first type of data is trend data 2020-2025, used for growth analysis. The second type of data is Cross-sectional data as of June 30, 2025, which is used for accurate analysis of the regional and gender aspects.
- **Thematic Scope:** The analysis is specifically focused on Digital Financial Services as defined by National Bank of Ethiopia and international organizations. It lists vital indications for DFS such as mobile money account, agent banking outlets and digital payment transactions. Financial inclusion is evaluated by account ownership and financial inclusion rate.

The study rigorously analyzes three elements of DFS, namely access, use and quality. It thoroughly accounts for moderating variables such as gender, location, digital literacy and the regulatory environment. The analysis does not include informal financing mechanisms unless they are linked to DFS adoption.

1.7 Limitations of the Study

This study has certain limitations that should be acknowledged.

Data Limitations

Secondary data was collected from National Bank of Ethiopia. These data are authoritative but have some constraints:

The cross-sectional dataset includes only gender as a demographic variable and no data on age, income, education, and occupation. This restricts the analysis of adoption patterns to demographic factors. Second, the dataset does not contain transaction-specific information such as types, frequencies, or amounts, which limits the ability to perform a more in-depth examination of consumption behaviors. Third, the cross-sectional data are only for June 30, 2025, not longitudinal, which limits the analysis of regional and gender-based temporal trends, even though the study uses trend data from 2020 to 2025.

1.8 Definition of Key Terms

Term	Definition
Financial Inclusion	Access to and usage of formal financial services by individuals and businesses. The ability to access and effectively use affordable financial products and services delivered in a responsible and sustainable manner (World Bank, 2021; Demirgüç-Kunt, Klapper, Singer, and Ansar, 2022).
Digital Financial Services (DFS)	Financial services are delivered via digital channels, including mobile money, agent banking, internet banking, and fintech applications (GSMA, 2022; World Bank, 2022).
Mobile Money	Digital financial service allowing users to deposit, withdraw, transfer money, and pay bills using mobile phones. Mobile money accounts are typically held by mobile network operators rather than banks (GSMA, 2023; Jack & Suri, 2014).
Agent Banking	Use of authorized third-party agents to deliver banking services on behalf of financial institutions. Agents typically include local shopkeepers, post offices, and other retail outlets (Mas & Kumar, 2008; Alliance for Financial Inclusion, 2020).
Digital Payments	Electronic transfer of funds between parties using digital channels, including mobile payments, electronic funds transfers, and card payments (World Bank, 2022).
Interoperability	The ability for different payment systems, mobile money platforms, and financial institutions to interact and enable transactions across platforms (Global Partnership for Financial Inclusion, 2022).
Digital Literacy	The skills, knowledge, and confidence to use digital technologies effectively, including the ability to navigate digital interfaces, understand digital services, and avoid security risks (ITU, 2021; GSMA, 2023).
NFIS II	National Financial Inclusion Strategy II (2021–2025), Ethiopia's roadmap for enhancing access, usage, and quality of financial services (National Bank of Ethiopia, 2021a).
NDPS	National Digital Payments Strategy (2021–2024). Ethiopia's framework for expanding digital payments (National Bank of Ethiopia, 2021b).
Telebirr	Ethiopia's largest mobile money platform, launched by Ethio Telecom in 2021 (Ethio Telecom, 2024).
Active Subscriber	A mobile money subscriber who has conducted at least one transaction in the past 30 days (as classified by NBE).

1.9 Organization of the Thesis

The thesis consists of five chapters.

Chapter 1 sets out the background to the study, states the problem, research questions and objectives and analyzes the significance, scope, limitations, definitions of important terms and the overall structure of the thesis.

Chapter two reviews relevant theoretical and empirical literature on digital financial services (DFS) and financial inclusion. It includes conceptual frameworks, theoretical bases, global and African evidence, Ethiopian context, various dimensions of DFS, moderating variables, empirical studies from Ethiopian universities, existing gaps, and conceptual framework.

Chapter Three covers the research design, data sources, variables, regional classifications, data analysis methodologies and ethical considerations.

Chapter Four is on data analysis and discussion. This chapter is broken into four sections. sections A is on the 2020-2025 trend analysis by regression. Part B is the examination of cross-sectional data from the National Bank of Ethiopia (NBE);

Chapter Five provides a summary of the research, the key findings, conclusions, recommendations for policy, contributions, limits, and future research directions.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

This chapter establishes the theoretical and empirical basis for the study. It covers financial inclusion, the AFI Access-Usage-Quality framework, the six DFS channels and their evidence foundation, Sarma IFI, gender issues, impediments to DFS impact, and Ethiopia's DFS trajectory. This chapter concludes with the conceptual framework and the identification of the research gaps addressed in this thesis.

2.2 The Concept of Financial Inclusion

2.2.1 Defining Financial Inclusion

The World Bank (2022) defines financial inclusion as "the availability of affordable, useful financial products and services – transactions, payments, savings, credit and insurance – provided responsibly and sustainably." It is well known as a major driver for various Sustainable Development Goals (SDGs). The United Nations (2020) sees financial inclusion as an enabler of certain targets, notably SDG 1 (No Poverty) where it enables households to save, invest and manage risk. It also contributes to SDG 5 (Gender Equality) by giving women economic and financial empowerment. Financial inclusion also contributes to SDG 8 (Decent Work and Economic Growth) by promoting savings and entrepreneurship and meets SDG 10 (Reduced Inequalities) by enhancing access to financial services for marginalized people.

2.2.2 Dimensions of Financial Inclusion

The literature stresses three core dimensions of financial inclusion (Sarma, 2015; Beck, Demirgüç-Kunt, and Peria, 2007; Global Partnership for Financial Inclusion, 2022):

1. Access: This pertains to the availability of financial services. This includes the physical proximity of service sites, cost and appropriate goods. It is usually quantified by indications of account ownership, density of branches and agents and cost.

2. Usage: This means the actual consumption of financial services, measured by the number of transactions, how often they are used, and the range of goods. Usage measurements measure the level of people's engagement with the financial system (Demirgüç-Kunt, Klapper, Singer, and Ansar, 2022).

3. Quality. The degree to which services are relevant and suited to users' demands. This includes product design, consumer protection, financial literacy and customer pleasure. As access and use increase, the focus on quality becomes increasingly important.

2.3 Digital Financial Services: Concepts and Evolution

2.3.1 Defining Digital Financial Services

Digital Financial Services (DFS) refer to financial services provided through digital platforms such as mobile phones, computers, payment cards and internet platforms (GSMA, 2023; World Bank, 2022). These services offer a comprehensive portfolio of solutions using digital technology to provide financial services that are more efficient, easy and accessible than traditional branch-based banking.

2.3.2 Evolution of DFS Globally

DFS has developed throughout time with innovation and new models (Mas & Kumar, 2008; Jack & Suri, 2014; Ozili, 2018; World Bank.

- Phase 1: 1990s-2000s: Branchless Banking (Retail agents used smart cards and POS terminals) Notable examples: Banco Popular (Brazil), Wizzit (South Africa) These showed banking outside the usual branches but ran into tech and legal hurdles.
- Phase 2: Mobile Money (2000s-2010s): Mpesa's launch in Kenya in 2007 showed that phones could be used for financial transactions, allowing unbanked Kenyans to send and receive money, and prompting similar projects across Africa.
- Phase 3: Fintech and Platform Integration (2010s-present): Fintech and digital platforms have extended the DFS ecosystem to digital credit, micro-insurance, savings and e-commerce with APIs for easy interaction.
- Phase 4: Digital Public Infrastructure (2020s-present): This phase sees a focus on digital IDs, interoperable payments and data interchange, with countries like India, Rwanda and Ghana building on the infrastructure for financial inclusion.

2.3.3 Components of DFS

A DFS normally consists of different components, which together constitute a full digital financial ecosystem (GSMA, 2023).

1. Mobile Money: These services allow customers to transfer, receive and store money using their mobile phones. They provide person-to-person transfers, bill payment, airtime top-up, merchant transactions and access to savings and credit choices.

2. Mobile Banking: Mobile banking is a banking service that is provided through mobile apps that allows customers to check account details, transfer funds, pay bills and do many other financial functions.

3. Agent Banking: This approach involves using approved third-party agents to deliver financial services such as cash deposits, withdrawals, account openings and basic transactions. It considerably reduces the cost of promoting financial inclusion and assists in reaching rural and distant locations.

4. Digital Payments: These are electronic fund transfers done through digital channels such as card transactions, electronic funds transfer, mobile payments , internet transactions and QR code payments.

5. Fintech Services: Innovative financial services using technology such as digital lending (immediate loans through mobile), micro-insurance (digital insurance products), robo-advisory (automatic investment advisory), peer-to-peer lending and crowdfunding.

2.4 Theoretical Frameworks

This analysis rests on four decisive theoretical perspectives that underpin the understanding of digital financial services (DFS) adoption, usage, and impact on financial inclusion.

2.4.1 Innovation Diffusion Theory (IDT)

Rogers (2003) The Diffusion of Innovations Theory accurately explains how new technologies are adopted in populations over time. Based on the Innovation Diffusion Theory (IDT), the acceptance of the innovations is determined by five essential characteristics:

• Relative advantage is the apparent way an innovation is considered superior to the idea it replaces. In a DFS setting, this advantage translates to reduced transaction costs, more convenience, faster service and better security compared to cash or traditional banking.

• Compatibility is always defined as the degree to which an innovation is perceived as consistent with the current values, past experiences, and needs of potential adopters. In the case of DFS, it is found that compatibility with users' financial practices, cultural norms and technological capabilities is crucial.

• Complexity refers to the degree to which an innovation is considered as difficult to use. The simpler the service, the more quickly it is embraced. "Ease of use is non-negotiable for DFS in low literacy environments.

• Trialability – the amount to which an idea can be tried on a limited basis. The opportunity to try DFS with small dollar amounts clearly minimizes perceived risk, and directly encourages adoption.

• Observability allows the results of the innovation to be observed by others. "Seeing friends and family use

DFS successfully will inevitably make people more likely to adopt the technology themselves. The rapid spreading of Telebirr in Ethiopia clearly shows relative benefit (reduced transaction costs, convenience), compatibility with common mobile phone usage, and observability through peer influence.

2.4.2 Technology Acceptance Model (TAM)

Davis (1989) proposed the Technology Acceptance Model (TAM) which strongly argues that the adoption of technology is driven by perceived usefulness or the assumption that employing a technology would lead to

better outcomes or performance. This notion extends to the DFS setting in which mobile money may save time, reduce transaction costs, provide access to credit, and other practical benefits.

Perceived ease of use is the extent to which a user believes technology is easy to use, including the interface, assistance and the user's trust.

The Technology Acceptance Model regularly directs DFS research across the continent of Africa. Tadesse and Abate (2022) found that user attitudes towards digital interfaces and institutional trust are decisive for DFS uptake in Ethiopia. (Gebrehiwot & Wolday, 2022) revealed that perceived usefulness and simplicity of use are separate and important indicators of mobile money adoption among the smallholder farmers in the Lake Tana area.

2.4.3 Financial Capability Framework

The Financial Capability Framework was developed by Sherraden (2013) and further worked on by Johnson and Sherraden (2007) who established categorical linkages between financial conduct and enabling settings. This paradigm proposes two interrelated dimensions:

Financial access means that appropriate financial products and services are available. It is concerned with whether people really have access to formal services that suit them. Financial knowledge and skills: making informed decisions and using services effectively. Even if users are encouraged to adopt DFS, the right infrastructure, regulations and digital literacy are needed. Lack of digital literacy is one of the critical barriers to the adoption of DFS in Ethiopia.

2.4.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was established by Venkatesh, Morris, Davis and Davis (2003) in which the Technology Acceptance Model was supplemented with determinants and moderating factors in a conclusive way. The four basic constructs of UTAUT are:

Performance expectancy refers to the degree of belief of users that technology may offer benefits. It is comparable to perceived usefulness in the Technology Acceptance Model. Effort expectancy is the ease of use of the technology and is similar to the perceived ease of use in TAM. Social influence is the extent to which users believe that important persons think they should utilize the technology. The facilitating conditions are the users' perceptions of the extent to which the organizational and technological infrastructure exists to facilitate use of the technology.

UTAUT considers moderators such as gender, age, experience, and voluntariness of use. This approach is particularly beneficial for DFS research because it incorporates social and contextual aspects that influence adoption of technology in low-income areas.

In Ethiopia, UTAUT has been successfully utilized to explore mobile banking adoption, where social impact and favorable conditions are particularly relevant for women and rural users (Gashaye and Tesfaye, 2024).

Table 2.1: Mapping of Theoretical Constructs to DFS Variables

Theory	Construct	Operational Definition in This Study	DFS Variable	Expected Sign
IDT (Rogers, 2003)	Relative Advantage	Lower transaction costs, faster service (measured by transaction value growth)	Mobile Money, Agent Banking	+
IDT	Compatibility	Alignment with existing cash-based habits (measured by adoption rate correlation)	Mobile Banking	+
TAM (Davis, 1989)	Perceived Usefulness	Active usage rate & transaction intensity (measured by d_u)	Usage dimension	+
TAM	Perceived Ease of Use	Difference in adoption between easy (mobile money) and complex (internet banking) channels	Penetration (d_p)	+
UTAUT (Venkatesh et al., 2003)	Facilitating Conditions	Agent density, ATM/POS availability (measured by d_a)	Availability dimension	+
UTAUT	Social Influence	Gender gap in participation (measured by female share)	Female IFI	–
Financial Capability Framework	Digital Literacy	Dormancy rate (proxy)	Moderating variable	–

The mapping in Table 2.1 directly informs the empirical models in Chapter 3. Specifically:

- IDT predicts that mobile money and agent banking (high relative advantage) will be the strongest drivers of IFI improvement – tested via channel contribution analysis.
- TAM predicts that perceived ease of use (proxied by mobile vs. internet banking adoption) influences penetration – captured in d_p.
- UTAUT predicts that facilitating conditions (agent density) and social influence (gender norms) affect usage and gender gaps – tested through regression Model 2 (dimensions) and Oaxaca-Blinder decomposition.

2.5 Global Evidence on DFS and Financial Inclusion

There is global evidence that Digital Financial Services (DFS) have played an important role in promoting financial inclusion, if the environment is conducive. Some of these factors are: regulatory clarity, agent network development, platform interoperability, financial literacy programs, and gender-focused tactics. These variables provide critical lessons for Ethiopia.

2.5.1 Clear Regulation and Policy Support

In Kenya, the Central Bank's relaxation of license rules, easing of KYC requirements, and allowing telecom-led DFS to flourish helped Mpesa grow from 27% in 2006 to over 80% in 2022, benefiting rural and low-income people the most (Jack & Suri, 2021). India linked compulsory accounts under PMJDY to G2P transfers and by 2023 had reached 470 million accounts, connecting DFS to welfare programs and using Aadhaar to speed processes and combat fraud. In 2021, 63% of the population in Rwanda had a mobile money account thanks to the government's concentration on digital infrastructure and the national digital ID (World Bank, 2022; Kaffenberger & Ruwet, 2021). In Nigeria, despite high mobile ownership, inconsistent regulations and delays in licensing hampered DFS expansion, and frequent regulatory changes and fragmented monitoring inhibited private innovation (Adebayo & Yusuf, 2023). It underscores the need for regulatory certainty and clarity.

Implications for Ethiopia: A clear innovation-friendly legal framework associated with the Digital Ethiopia 2025 plan is critical to building trust, enabling private-sector participation, and facilitating inclusive DFS adoption. While regulatory measures such as the Mobile Money Directive 2020, Agent Banking Directive 2021, and Proclamation No. 1282/2023 have established an enabling environment in Ethiopia, continued attention to implementation and enforcement is needed.

2.5.2 Agent Network Expansion and Last-Mile Outreach

Evidence from Bangladesh, Kenya and Rwanda shows the importance of dense and well-supported agent networks to enhance DFS adoption. bKash in Bangladesh has widened financial services through 350,000+ agents throughout the nation, offering services to both urban and rural communities (Rahman, Jahan, and Chowdhury, 2023). This means that agent networks are the physical bridge between digital systems and cash economies.

The spread of DFS in Rwanda was backed by community-based kiosks coupled with a strong government-private partnership (Ngugi & Awuor, 2022) that enabled constant connectivity in the remote areas. The success of Kenya's M-Pesa agents indicates the significance of extensive coverage, liquidity management and user training (Jack & Suri, 2021). The agents need enough cash to make withdrawals and enough electronic value to make deposits, and an imbalance reduces confidence. Countries like Nigeria which did not support agents had increased unhappiness, limited rural utilization, and trust issues (Osei & Boateng, 2022). Training of agents, liquidity and monitoring are essential for sustainable networks.

Implications for Ethiopia: Digital financial services platforms like Telebirr have been established, but cross-sectional NBE data shows that the top three regions (Oromia, Addis Ababa and Amhara) hold 75.5% of all bank agents, while peripheral regions are underserved. To enhance financial inclusion in the last mile, there is a need to increase agent recruitment in Somali, Afar and Gambella, decentralize the management of cash float and provide capacity building support.

2.5.3 Platform Interoperability and Ecosystem Integration

One of the major themes in worldwide DFS expansion is integration of platforms across financial institutions, telecoms and government systems. So in 2019, Ghana passed measures to make mobile money providers and banks fully interoperable, allowing for smooth payments. The DFS adoption in 2023 was 68% among people, particularly women and small enterprises (Osei & Boateng, 2022). This demonstrates how interoperability decreases fragmentation, increases convenience and expedites DFS implementation, all without the need for numerous accounts. However, research from Nigeria and Tanzania reveal that ecosystems that are fragmented inhibit adoption, increase prices and decrease convenience (Kumar & Srivastava, 2023). India's UPI exhibits interoperability, unifying banking apps, fintech wallets, and merchant platforms, with 9 billion monthly transactions projected by 2024 (World Bank, 2023). That shows the promise of open, standards-based payment systems.

Implications for Ethiopia The DFS ecosystem in Ethiopia remains fragmented with few cross-platform interoperability such as Telebirr, HelloCash and Amole (World Bank, 2023). Opening up standardized platforms through regulatory change is key to ease of use, increased competition and faster inclusion. The National Bank of Ethiopia's push for interoperability through EthSwitch is a step in the right direction but full compatibility has not yet been realized.

2.5.4 Financial Literacy and Trust-Building Initiatives

Research shows that infrastructure, digital and financial literacy impact the adoption of DFS. Radio, TV and community gatherings have boosted rural women's use of mobile money in Bangladesh by 40 percent through awareness campaigns. In India, the financial literacy activities of the PMJDY resulted in people creating accounts and adopting digital payments, resulting in a fall in fraud. Consumers can find it hard to use mobile wallets without any literacy aid, which increases the danger of fraud and reliance on intermediaries. Trust building entails transparency of grievance mechanisms, cybersecurity and public education, consumer protection with transparent fees, accessible channels for complaints and dispute resolution.

Implications for Ethiopians: The lack of digital literacy is still a major obstacle, in particular for women and rural areas. 66% of women and 60% of men are not proficient in mobile money (NBE, 2024). Financial education along with deployment of DFS and anti-fraud awareness programmes can boost trust and promote

sustainable adoption. The National Financial Education Strategy (2021-2025) provides a framework, but more extensive implementation is needed.

Gender-Inclusive Strategies for DFS Adoption

There is global evidence that gender equity leads to better financial inclusion. In Ghana, targeted microfinance and simple KYC increased female DFS by 28% (Osei & Boateng, 2022). Ghana allowed other IDs, lowering obstacles to account opening. Kenya's focus on women in agent recruitment and digital training eliminated gender imbalances (Jack & Suri, 2021). Women agents dealt well with women customers. Bangladesh's bKash collaborated with NGOs to provide services to women in rural areas, increasing household savings (Rahman, Jahan, and Chowdhury, 2023). These are cross-cultural links that facilitate DFS. However, social-cultural hurdles lead to gender imbalance in DFS in Nigeria and Tanzania (Adebayo & Yusuf, 2023). The gender-blind design of DFS is male-biased and reinforces inequality.

2.6 DFS in Africa: Regional Experiences

2.6.1 Kenya: The M-Pesa Success Story

M-Pesa increased financial access from 26% to more than 83% and helped move 194,000 households out of poverty (Jack & Suri, 2014; Suri & Jack, 2016). Success factors: First mover advantage, broad agent network (200,000+ agents), enabling regulation.

2.6.2 Tanzania: Competitive Market Dynamics

In Tanzania, a competitive mobile money space (Vodacom M-Pesa, Tigo Pesa, Airtel Money) stimulated innovation and outreach to rural areas. Financial inclusion increased from 12% (2009) to 65% (2017) (Mbiti & Weil, 2015).

Comparison with Ethiopia Ethiopia's DFS market is becoming more competitive with the arrival of Telebirr (Ethio Telecom) and Safaricom Ethiopia, but Telebirr is still the leader.

2.6.3 Ghana: Interoperability as an enabler

In Ghana, full interoperability was legislated across mobile money providers and banks, and DFS use reached 68% of people in 2023 (Osei & Boateng, 2022).

Comparison with Ethiopia: The DFS ecosystem in Ethiopia remains fragmented, with minimal compatibility between banks & DFS providers.

2.6.4 Rwanda: Government-Led Approach

The government-led effort, which involved a national digital ID and interoperable payment switch, contributed to mobile money reaching 63% of adults in Rwanda by 2021 (Kaffenberger & Ruwet, 2021).

Comparison with Ethiopia The Ethiopian government has also taken a lead role through programs such as NFIS II, NDPS, and Digital Ethiopia 2025 Strategy. The Fayda digital ID initiative is similar to the digital ID system in Rwanda.

2.6.5 Implications for Ethiopia

Ethiopia's experiences in several African countries provide useful lessons:

1. Regulatory reform to allow non-banks to participate is key (GSMA, 2023). Ethiopia has moved a step ahead with Proclamation No. 1282/2023 but an emphasis on regulatory execution is crucial.
2. Interoperability lowers fragmentation and improves consumer comfort (Global Partnership for Financial Inclusion, 2022). The existing segregated ecosystem that prevents user convenience includes banks and DFS providers. Ghana has made interoperability mandatory, which might lead to a big boost in adoption.
3. Strong networks of agents are important to reach rural people (Mas & Kumar, 2008).
4. Competition among suppliers fosters innovation and enhances the quality of services (Aker & Mbiti, 2010). The arrival of Safaricom is opening up the Ethiopia's market but Telebirr still dominates. Encouraging competition might be good for consumers.
5. Training digital literacy increases adoption and decreases vulnerabilities (Johnson & Sherraden, 2007). Ethiopia has a high rate of mobile money literacy with 66% of women and 60% of men lacking mobile money capabilities (NBE, 2024) and needs to improve digital literacy programs.
6. Gender-inclusive initiatives are crucial to bridging the gender gap (GSMA, 2023). Ethiopia has a 30.2 percentage points gender gap and hence should focus on women-focused DFS products and women agent recruitment, as well as targeted digital literacy programs.
7. Government leadership can expedite progress on DFS (World Bank, 2022). Ethiopia's NFIS II, NDPS, and Digital Ethiopia 2025 Strategy provide a solid foundation but their execution needs more consolidation.

2.7 DFS in Ethiopia: Context and Evolution

2.7.1 Historical Context

Before the DFS growth, Ethiopia's financial environment was characterized by limited access, state domination and severe exclusion (National Bank of Ethiopia, 2023a). In 2017, just 35% of adults have access to formal banking services. Rural areas were especially underserved: only 22% of rural adults had any formal financial account, compared with 75% in metropolitan areas.

The traditional banking system was dominated by state-owned institutions, with the Commercial Bank of Ethiopia accounting for more over 60 percent of banking assets (National Bank of Ethiopia, 2023a). There were private banks in the country, but they were geographically constrained. In practice, bank accounts were mostly inaccessible to most Ethiopians.

More than 50 MFIs were functioning around the country and had an important role in supporting low-income populations (Aredo, 2023). However, MFIs struggled with limited capital, geographic specialization and constrained product options. While MFIs succeeded to cover some of the financially excluded, a large segment of the population was left out.

2.7.2 Regulatory Framework Evolution

Since 2020, the regulatory framework for DFS in Ethiopia has been fundamentally changed (National Bank of Ethiopia, 2022; Ahmed, 2023):

Year	Reform
2012	**Payment System Proclamation:** established the National Bank of Ethiopia's authority over payment systems but restricted payment services to banks. While this framework reflected the prevailing view of banks as the sole legitimate providers of financial services, it created barriers to innovation in digital financial services (DFS).
2020	**The Payment System Proclamation Amendment** initiated the process of opening the payment system to non-bank entities. This amendment enabled the licensing of payment instrument issuers and payment system operators, thereby facilitating the entry of non-bank DFS providers. Payment System Amendment (non-bank entry)
2021	• **The launch of Telebirr** by Ethio Telecom marked a significant turning point, demonstrating the potential of mobile money in Ethiopia. Telebirr registered over 34 million users within two years of its introduction. • **National Financial Inclusion Strategy II (2021–2025)** was launched, setting targets for financial inclusion and identifying DFS as a key mechanism. The strategy aims to increase financial inclusion to 70% by 2025. • **National Digital Payments Strategy (2021–2024)** was launched, providing a framework for expanding digital payments, improving payment system efficiency, and promoting the transition to a cash-lite economy.
2023	• **Proclamation No. 1282/2023** opened the payment system to foreign providers and enabled non-bank entities to offer payment services directly. This reform enabled Safaricom Ethiopia to enter the market. • **Licensing Directives** were issued, establishing detailed requirements for non-bank payment providers, mobile money operators, and payment system operators.

2.8 Dimensions of DFS and Financial Inclusion

2.8.1 DFS Access

DFS access refers to the availability of digital financial channels for account opening and transactions (GSMA, 2023; World Bank, 2022). Indicators include digital accounts, agent density, network coverage, ATM and POS density and price of service. Access alone does not guarantee financial inclusion (Demirgüç-Kunt et al., 2022).

2.8.2 DFS Usage

The use of DFS is a proxy for the degree of active use of digital accounts and is seen as a better measure of financial inclusion than simply ownership (Demirgüç-Kunt, Klapper, Singer and Ansar, 2022). It covers a broad set of activities such as payments (P2P, P2B, utility, merchant), remittances, savings, digital credit, micro-insurance and others.

Evidence suggests it's digital use, not simply access, that promotes welfare. Suri and Jack (2016) showed lower poverty and greater consumption smoothing among active Mpesa users in Kenya than inactive accounts.

2.8.3 DFS Quality

Quality in DFS implies reliability, trust and user experience in digital financial services that encompasses reliability, affordability, transparency, security and consumer protection (Global Partnership for Financial Inclusion, 2022; GSMA, 2023). Low quality erodes trust and limits usage, as shown by the system downtime and fraud problems in Nigeria, while Ghana's improvements in system stability and consumer protection enhanced trust (Adebayo & Yusuf, 2023; Osei & Boateng, 2022). Challenges in Ethiopia include unreliability of the network, transaction failures, shortage of agent liquidity, and security concerns, with 52% of non-users citing fraud as a barrier (Teshome & Kebede, 2023; Girma & Tadesse, 2024; NBE, 2024; Abate, Tufa, and Kassa, 2022).

2.9 Moderating Variables Affecting the DFS–Financial Inclusion Relationship

2.9.1 Gender

There are a number of structural restrictions that greatly influence women's uptake and utilization of digital financial services (GSMA, 2023; Gashaye & Tesfaye, 2024). First, women are less likely to possess mobile phones independently; in Ethiopia, for example, just 65% of women own mobile phones compared with 85% of males (GSMA, 2023), which creates a basic barrier to access to DFS. Secondly, low levels of digital literacy further constrain women's capacity to utilize DFS independently, with NBE (2024) noting that 66% of women do not have mobile money skills vs 60% of males. Third, many Ethiopian homes adhere to cultural traditions that give the power of financial decision-making to men, therefore limiting the financial autonomy of women

(Kebede & Alemu, 2021). Finally, the economic dependence of women increases these barriers by lowering their necessity and capability to engage with formal digital financial services.

2.9.2 Rural–Urban Location

Different restrictions in rural locations greatly impact the adoption and use of DFS (Girma & Tadesse, 2024; Teshome & Kebede, 2023). Rural locations have much less mobile network coverage than urban areas, limiting connectivity and access to digital platforms. Agent networks remain highly concentrated in urban areas, leaving rural kebeles sometimes without accessible cash-in and cash-out terminals. The average digital literacy levels of rural communities also tend to be lower, limiting their capacity to browse and utilize DFS platforms on their own. Rural economies are also more cash-dominated, which limits the real-world use cases for digital financial services and reduces incentives to adopt, adding to these difficulties.

2.9.3 Digital Literacy

Digital literacy involves skills, knowledge and confidence in the use of digital technology that is effective (ITU, 2021; GSMA, 2023) It addresses four main areas: technical abilities including utilizing interfaces and apps; security awareness around fraud and safe practices; financial know-how on fees and interest; and confidence to use digital services autonomously.

In Ethiopia, the gaps in digital literacy are large. Gender neutral 66% of women and 60% of men do not have mobile money skills (NBE, 2024). Lowest levels are in rural areas and among older individuals and less educated groups. Highest levels are among urban and younger, educated populations. These differences mirror and perpetuate socioeconomic differences.

Limited digital literacy prevents customers from opening accounts or making transactions, impeding DFS acceptance and usage. It limits use to simple operations, shunning complicated services like savings and credit. People with low literacy are more vulnerable to fraud because they are less able to identify and protect themselves against schemes.

2.9.4 Regulatory Environment

The regulatory environment is vital to DFS growth and financial inclusion, with important elements such as licensing, KYC, consumer protection, interoperability, and agent banking influencing participation and confidence (World Bank, 2023; Alliance for Financial Inclusion, 2020).

Ethiopia has experienced positive regulatory advancements including directions and strategies (2021- 2022), however holes remain- interoperability is not mandated, consumer protection enforcement is weak, and fintech licensing is delayed.

Innovation sandboxes and simplified KYC procedures provide opportunities to improve regulation, particularly for underprivileged communities.

2.10 Sarma's Index of Financial Inclusion

2.10.1 Why a Composite Index Is Needed

A single indicator—such as the number of accounts—cannot capture whether those accounts are used, or whether women and rural populations are included. To address this, Sarma (2008, 2016) developed the Index of Financial Inclusion (IFI), modelled on the United Nations Human Development Index. The IFI combines three dimensions—Penetration, Availability, and Usage—into a single score between 0 and 1 using a transparent distance-based formula.

2.10.2 Two Versions: 2008 and 2016

The original **2008 version** normalises each dimension using the minimum and maximum values observed within the dataset (e.g., across countries, years, or regions). This makes the IFI a purely relative measure, useful for cross-sectional comparisons but limited for tracking progress over time because the scale shifts whenever new data are added.

To address this limitation, **Sarma (2016)** introduced fixed, externally chosen minima and maxima for each dimension indicator. Just as the Human Development Index fixes life-expectancy bounds between 20 and 85 years, the 2016 IFI sets constant reference points that represent "worst" and "ideal" levels of financial inclusion. This yields an absolute scale that remains stable over time, enables policy-makers to set clear quantifiable targets, and allows meaningful comparisons across periods.

2.10.3 Adapting the IFI for This Study

For this thesis, the original IFI is adapted to incorporate all six DFS channels:

- **Penetration (d_p):** DFS accounts per 1,000 adults, calculated as the sum of Mobile Money accounts, Mobile Banking subscribers, and Internet Banking accounts, divided by the adult population and multiplied by 1,000.
- **Availability (d_a):** DFS touchpoints per 100,000 adults, calculated as the sum of ATM terminals, POS terminals, and bank agents, divided by the adult population and multiplied by 100,000.
- **Usage (d_u):** A composite usage score, calculated as the weighted average of the active account rate (60 % weight) and a transaction intensity score (40 % weight).

For the national time-series, Penetration and Availability use the Sarma (2016) absolute benchmarks. Usage is normalised relative to the six-year national range (Sarma 2008) to prevent scale compression. The resulting raw IFI is linearly rescaled to align with the regional classification scale. The regional IFI uses the standard Sarma (2008) within-dataset min-max for all three dimensions. This hybrid approach is fully justified in Section 3.4.

2.11 Empirical Studies

Table 2.10: Summary of Key Empirical Studies on DFS and Financial Inclusion

No.	Thesis Title / Study Focus	Author(s) & Year	Country / Region	Key Findings	Recommendations
1	The long-run poverty and gender impacts of mobile money	Suri and Jack (2016)	Kenya	M-Pesa lifted 194,000 households out of poverty; female-headed households benefited most	Expand mobile money to rural areas; target women for financial inclusion
2	Mobile money adoption and regulatory regimes in Ghana	Osei and Boateng (2022)	Ghana	Interoperability mandate increased DFS adoption to 68%; simplified KYC increased female adoption by 28%	Mandate full interoperability; simplify KYC for women
3	Digital financial inclusion in Rwanda: Progress and prospects	Kaffenberger and Ruwet (2021)	Rwanda	Mobile money reached 63% of adults; digital ID and government leadership are critical	Invest in digital ID; provide government leadership; promote PPPs
4	bKash and financial empowerment in Bangladesh	Rahman, Jahan, and Chowdhury (2023)	Bangladesh	350,000+ agents deployed; digital awareness campaigns increased rural women's usage by 40%	Partner with NGOs; recruit women agents; design women-focused products
5	Financial inclusion through DFS: Lessons from PMJDY	Kumar and Srivastava (2023)	India	PMJDY achieved 470 million accounts; G2P transfers and financial literacy drove adoption	Integrate DFS with welfare programs; invest in financial literacy at scale
6	Barriers to DFS adoption in rural Ethiopia	Teshome and Kebede (2023)	Ethiopia	Primary barriers: low digital literacy, limited agent accessibility, trust concerns	Invest in digital literacy; expand agent networks; community-based trust-building

7	Gender dimensions of mobile money adoption in urban Ethiopia	Gashaye and Tesfaye (2024)	Ethiopia	Women face barriers: lower phone ownership, low digital literacy, and cultural constraints	Gender-responsive product design; targeted digital literacy programs
8	Mobile money adoption among pastoralist communities in Somali region	Gemechu and Fufa (2023)	Ethiopia	Adoption constrained by limited network coverage, low digital literacy, and cultural barriers	Invest in infrastructure; community-based training approaches
9	Mobile money adoption among smallholder farmers	Gebrehiwot and Wolday (2022)	Ethiopia	Perceived usefulness, ease of use, and social influence significantly predict adoption	Farmer-focused product design; peer-to-peer learning approaches
10	Impact of mobile money on agricultural marketing	Kassie, Alemu, and Mulugeta (2024)	Ethiopia	Mobile money is associated with improved market access, higher prices, and reduced transaction costs	Expand agent networks; improve digital literacy

Source: Author's compilation based on reviewed literature

The above-described Ethiopian studies have a number of flaws that this thesis aims to address:

- Single-channel focus: Several studies focus on either mobile money adoption (Gemechu & Fufa, 2023) or agent banking (Teshome & Kebede, 2023) and do not address the joint influence of all six DFS channels.

  Descriptive analysis: Many use descriptive statistics or simple frequencies, without composite indices or inferential procedures (Abebe, 2021; Zewdie, 2020).
- No channel contribution quantification: No study has quantified the contribution of each DFS channel to the overall financial inclusion improvement.
- No gender gap decomposition: Although gender gaps are identified, no study decomposes whether the gap arises from infrastructure or non-infrastructure variables.
- No policy scenario simulation No study simulates future inclusion outcomes under alternative policy actions.

This thesis solves all five holes by developing a multi-channel Sarma IFI, quantifying channel contributions, performing Oaxaca-Blinder decomposition, and simulating five policy scenarios up to 2028.

2.12 Gaps in the Literature

The literature study above points to the existence of major gaps even though there are a number of research conducted on Digital Financial Services (DFS) and financial inclusion in Ethiopia. In particular:

- Multi-Channels Composite Measurement Gap: None of the earlier studies in Ethiopia have built a composite index of financial inclusion incorporating all the six DFS channels (ATMs, POS, mobile banking, internet banking, agent banking and mobile money). The available research are limited to one channel (e.g., adoption of mobile money) or different indicators without aggregation (Abebe, 2021; Zewdie, 2020; Teshome & Kebede, 2023).
- Quantifying channel contribution Gap: The literature has not measured the relative impact of each DFS channel to the overall financial inclusion improvement. Policymakers do not have empirical data as to the channels that provide the highest returns for resource allocation.
- Gender Gap Decomposition Gap: Gender gaps in DFS adoption are acknowledged (Kebede & Alemu, 2021; Gashaye & Tesfaye, 2024), but no research has decomposed whether the gender gap is driven by infrastructure (supply-side) or non-infrastructure (demand-side) factors like cultural norms, mobile phone ownership, or digital literacy.
- Policy scenario simulation gap: No study has simulated the future impact of alternative policy initiatives (e.g., usage activation versus infrastructure expansion) on financial inclusion outcomes in Ethiopia. There are no evidence-based projections in strategic planning.

This thesis directly addresses each of the four gaps:

- It constructs a six-channel Sarma Index of Financial Inclusion (IFI) using NBE administrative data (2020-2025) and UN/ESS population estimates.
- It quantifies the contribution of each DFS channel to the national IFI improvement (e.g., agent banking , mobile money).
- It applies Oaxaca-Blinder decomposition to separate the gender gap into explained (infrastructure) and unexplained (non-infrastructure) components.
- It simulates five policy scenarios to 2028 (baseline, accelerated availability, usage activation, gender equity focus, full maximisation) to project future IFI and active adult inclusion rates.

2.13 Conceptual Framework

Based on the studied theoretical and empirical literature, this study uses the following conceptual framework. The conceptual framework provides a systematic portrayal of the effect of Digital Financial Services (DFS) on financial inclusion in Ethiopia. It links DFS access, DFS usage and DFS quality (independent variables) with financial inclusion outcomes (dependent variable) and recognises that the strength and direction of these relationships are affected by moderating variables (gender, location, digital literacy and the regulatory environment).

2.13.1 Independent Variables (DFS Dimensions)

A. DFS Access: The availability and accessibility of digital financial channels for individuals to open accounts and carry out financial activities. Indicators are : Ownership of mobile money, mobile banking and internet banking accounts; ATM, POS and agents' density

B. DFS Use: Refers to the actual use of digital financial services by users for various financial transactions. Indicators include: Frequency of transactions Diversity of use cases (payments, savings, credit, insurance) Transaction value Active vs. non-active status

C. DFS quality: It refers to reliability, credibility and user experience of digital financial services. Measurements are:

- System availability and transaction success rates
- Cost (transaction fees, hurdles to cost)
- transparency (clear pricing, user-friendly interfaces)
- Safety (fraud control, data security)
- Consumer protection (complaints, dispute resolution)

2.13.2 Moderating Variables

The impact of DFS on financial inclusion is determined by several factors:

- Gender: Women face extra challenges include limited access to mobile phones, lesser digital literacy and social standards (Kebede & Alemu, 2021; Gashaye & Tesfaye, 2024)
- Location: Urban locations have stronger network connectivity, more agents and higher digital literacy (Girma & Tadesse, 2024)
- Digital Literacy: The higher the literacy the more confident, less risk of error and more adoption and depth of use (Tadesse & Abate, 2022)
- Regulatory Environment: Supportive regulations (e.g., interoperability, flexibility in KYC, consumer protection) enhance DFS performance and adoption (World Bank, 2023)

2.13.3 Dependent Variable: Financial Inclusion Outcomes

Financial inclusion is defined as the extent to which individuals and enterprises have access to and effective use of financial services. These services include:

- Account ownership
- Use of financial instruments (payments, savings, credit, insurance)
- Credit access
- Behaviour as saving

2.13.4 Conceptual Framework Diagram

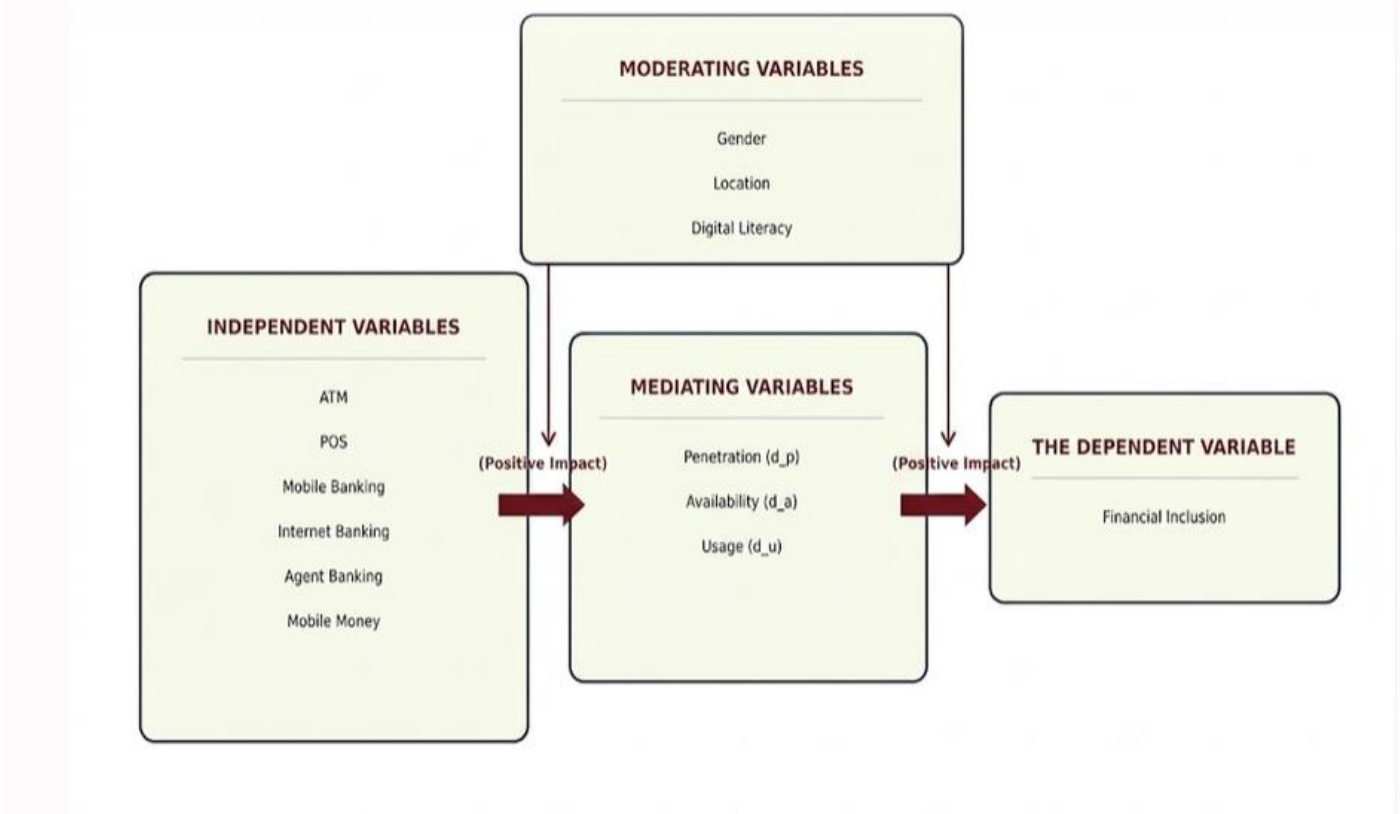


Figure 2.1:Conceptual Framework of DFS and Financial Inclusion

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the study techniques employed to explore the role and impact of Digital Financial Services (DFS) on financial inclusion in Ethiopia. This section discusses the research philosophy, research design, data sources, study variables, regional classification, data analysis procedures, and ethical considerations.

3.2 Research Philosophy

The study uses a positivist epistemology that financial inclusion is a measurable objective phenomenon and the favourable effect of DFS can be empirically demonstrated through rigorous quantitative analysis (Saunders, Lewis & Thornhill, 2019). This study adopts a deductive approach, where theoretical assumptions are based on the AFI Access–Usage–Quality framework and the finance growth nexus and tested using administrative data from the National Bank of Ethiopia (Bryman, 2016).

3.3 Research Design

The research design is quantitative, analytical, and multi-method (Creswell & Creswell, 2018). The core analytical model is the Sarma Index of Financial Inclusion (IFI), constructed for both a national time-series (2020-2025) and a regional cross-section (14 regions, June 2025). This core model is supplemented by descriptive statistics, logistic diffusion modelling, Pearson correlation analysis, multiple OLS regression, Oaxaca-Blinder decomposition, dormancy and barrier analysis, and scenario simulation. The research strategy is archival, drawing on secondary administrative data from the NBE (Yin, 2018). The time horizon is longitudinal for the national analysis and cross-sectional for the regional analysis (Saunders et al., 2019).

The design of the research is analytical, multi-method and quantitative. The primary analytical model is the Sarma Index of Financial Inclusion (IFI), calculated for both a national time series (2020-2025) and a regional cross-section (14 regions, June 2025). At its heart, this approach is complemented by:

- Descriptive statistics and trend analysis (CAGR, line graphs and time series decomposition)
- Logistic diffusion modeling (to estimate the phases of adoption of each DFS channel)
- Pearson correlation analysis (regional and national matrices)
- Multiple OLS regression (robust standard errors)
- Oaxaca Blinder style gender breakdown
- Barrier and dormancy analysis (classification and residual analysis)

- Scenario simulation (five different policy scenarios forecast until 2028)

Why trend analysis (2020-2025) and cross-sectional (2025) designs? The study has two distinct objectives: (a) track the growth of DFS over time (RQ1) and (b) analyse regional disparities and causal relationships at a single point in time (RQ2-RQ4). A time-series design is appropriate for growth trends (CAGR, logistic S-curve). A cross-sectional design is appropriate for regional comparisons and regression because the IFI and active usage data are only available for a single year (June 2025) at the regional level. Longitudinal regional data are not yet available; future research could use panel methods once multiple years of regional data accumulate.

Why the Sarma IFI? The Sarma IFI was chosen over other composite indices (e.g., IMF Financial Inclusion Index, AFI Core Set) because: (a) it is multidimensional (penetration, availability, usage); (b) it allows fixed benchmarks for time-series tracking and min-max normalisation for cross-sectional comparison; (c) it is widely cited and used by central banks (e.g., Reserve Bank of India).

Why OLS regression? The dependent variables (active usage rate, female participation ratio) are continuous and approximately normally distributed. OLS is appropriate and interpretable. Robust standard errors (HC3) are used to address potential heteroskedasticity given the small sample size (N=14).

Why Oaxaca-Blinder decomposition? This method uniquely separates the gender gap into "explained" (due to differences in infrastructure) and "unexplained" (due to non-infrastructure factors). It is the standard for gender gap decomposition in economics and has been applied in financial inclusion research (e.g., World Bank, 2022).

3.4 Data Sources

This analysis includes secondary data from National Bank of Ethiopia. The data were supplied in three datasets with varied DFS stats by dimension.

3.4.1 National Trend Data (datasets 1 and 2)

Dataset 1: "accounts – trend 2020-2025."
This chart includes annual numbers for fiscal years 2020 to 2025. Six annual observations are obtained for this study which only uses the period 2020-2025. The dataset reads:
• No. of ATM terminals
• Number of POS terminals
• Number of Mobile Banking users
* Number of accounts with online banking
• Number of mobile money accounts (all providers)
• Mobile Money agent network size

Dataset 2: “transactions”

This sheet also shows the annual transaction volume (in millions) and transaction value (in billions of ETB) for each of the six DFS channels throughout the same 2020-2025 period. ATM, POS, Mobile Banking, Internet Banking, Agent Banking and Mobile Money are the channels covered.

Datasets 1 and 2 are utilized to do the national time series analysis including calculating the national Sarma IFI, compound annual growth rate calculations, logistic diffusion modeling and trend regression.

3.4.2 Regional Cross-Sectional Data (Dataset 3)

Dataset 3: “Cross-section as of June 2025.”

The sheet gives a snapshot as of June 30, 2025 disaggregated by all 14 Ethiopian administrative areas. It reports, for each region:

• Number of ATM machines and POS machine

• Bank agents’ number

• Mobile Money customers by: Male, Female, Business Entity, Active and Non Active

• Mobile Banking members by: Male, Female, Business Entity, Active, Non Active

• Internet Banking customers disaggregated by: Male, Female, Business Entity, Active, Non Active

• Telebirr and other non bank mobile money accounts – summary data (country totals, not disaggregated by area)

Dataset 3 is employed for all regional cross sectional analyses including the development of the regional IFI, correlation analysis among the six per capita DFS variables, multiple regression, gender disaggregated IFI calculation and barrier analysis.

3.4.3 Supplementary Data

This study uses the United Nations World Population Prospects (2024 Revision) as the source for national population estimates. The mid-2025 total population of Ethiopia is 135,472,051 (rounded to 135.47 million). The adult population (aged 15-64) is derived from the UNFPA’s working-age share of 57.93% , resulting in 78.5 million adults.

The United Nations does not publish official regional population data for Ethiopia. Therefore, regional population distributions are derived from the proportional shares of the Ethiopian Statistical Service (ESS) 2024 regional projections. ESS regional shares are calculated as each region’s population divided by the ESS national total (approximately 109 million). These shares are then applied to the UN national total (135.47 million) to obtain UN-aligned regional totals. Regional adult populations are calculated by applying the UN adult share (57.93%) to each region’s total.

Policy Documents: The policy targets used in the alignment analysis were sourced from Ethiopia’s National Financial Inclusion Strategy (NFIS, 2021-2025), the National Digital Payments Strategy (NDPS, 2021-2024),

and relevant National Bank of Ethiopia directives (notably the Agent Banking Directive), and these were consulted as context for interpreting the findings.

3.4.4 Analytical Handling of Data Limitations

The study relies on secondary administrative data from the National Bank of Ethiopia (NBE). While this data is authoritative, it has inherent limitations that are addressed as follows:

1. Limited demographic variables (only gender). The cross-sectional data does not include income, education, or occupation. This restricts the ability to control for socioeconomic factors in regression. To mitigate, the study focuses on regional-level analysis (14 regions), where aggregate trends are less sensitive to individual-level omitted variables. Moreover, the Oaxaca-Blinder decomposition isolates the "unexplained" component of the gender gap, which captures the combined effect of omitted variables (cultural norms, phone ownership, literacy). This provides indirect evidence of non-infrastructure barriers even without direct measurement.

2. No transaction-level data (frequency, value, type). The dataset provides only aggregate transaction volumes and active/inactive status, not individual transaction logs. Consequently, "usage" is proxied by (a) the active usage rate (30-day activity) and (b) transaction intensity (total volume per adult). Both are standard proxies used by the NBE and GSMA for cross-regional comparison (GSMA, 2023; NBE, 2024). This is sufficient for the research questions, which focus on regional disparities and overall inclusion levels, not individual transaction behaviour.

3.5 Variables of the Study

3.5.1 Independent Variables: The Six DFS Channels

In the regional cross-sectional analysis, all six DFS variables are scaled to be per 100,000 adults to provide a fair comparison across regions with radically varying population size. In the raw indicator calculations for the national time series analysis, the indicator calculations use absolute values and population denominators.

Table 3.1: Variable Definitions for the Six DFS Channels

Variable	Abbreviation	Definition (per 100,000 adults)	Expected Sign
ATM Density	ATM	Number of ATM terminals ÷ Adult Population × 100,000	+
POS Density	POS	Number of POS terminals ÷ Adult Population × 100,000	+

Mobile Banking Penetration	MB	Number of Mobile Banking subscribers ÷ Adult Population × 100,000	+
Internet Banking Penetration	IB	Number of Internet Banking accounts ÷ Adult Population × 100,000	+
Agent Banking Density	Agent	Number of bank agents ÷ Adult Population × 100,000	+
Mobile Money Penetration	MM	Number of bank-led Mobile Money accounts ÷ Adult Population × 100,000	+

All six variables are expected to have a positive impact on financial inclusion, based on the theoretical and empirical literature reviewed in Chapter 2.

3.5.2 Dependent Variable (Financial Inclusion Outcome)

The primary dependent variable used to validate the IFI is the **Active Usage Rate**, calculated for each region as:

$$\text{Active Usage Rate} = \frac{\text{Active MM} + \text{Active MB} + \text{Active IB}}{\text{Total MM} + \text{Total MB} + \text{Total IB}} \times 100$$

This measures the proportion of all DFS accounts (across the three account-based channels) that are actively used. It is a direct indicator of genuine, usage-based financial inclusion—the ultimate outcome the IFI is intended to capture.

3.5.3 Gender Equity Outcome

The **Female Participation Ratio (FPR)** is used as a gender equity outcome and is calculated as:

$$\text{FPR} = \frac{\text{Female subscribers (MM} + \text{MB} + \text{IB)}}{\text{Male subscribers (MM} + \text{MB} + \text{IB)} + \text{Female subscribers (MM} + \text{MB} + \text{IB)}} \times 100$$

This captures the share of women among DFS users across all three account-based channels.

3.5.4 Regional Adult Population Estimates

Table 3.2: Regional Adult Population Estimates (Age 15+), June 2025

Region	Total Population (Millions)	Adult Population (Millions)

Addis Ababa	4.97	2.88
Dire Dawa	0.70	0.41
Tigray	7.33	4.25
Afar	2.67	1.55
Amhara	29.21	16.94
Oromia	52.20	30.28
Somali	10.46	6.07
South Ethiopia	29.38	17.04
Harari	0.37	0.21
Benshangul-Gumuz	1.69	0.98
Gambella	0.66	0.38
Sidama*	2.51	1.45
*South West Ethiopia **	1.63	0.94
Central Ethiopia*	2.03	1.18
National Total	**135.47**	**78.50**

Notes: Sidama, Central Ethiopia, and South West Ethiopia became regions after the 2007 census. Their shares are estimated from former SNNP territory.
Sources: National total and adult share from UN DESA (2024); regional shares from ESS (2024); calculations by author.

3.5.5 Moderating variables

The conceptual framework identifies the gender, geography, and digital literacy as moderating variables. They are listed as:

Gender: IFI ratings are calculated separately for boys and girls (see Appendix C). The Oaxaca Blinder decomposition clearly measures the contribution of disparities in infrastructure (penetration, availability) and unexplained factors (cultural norms, phone ownership, literacy) to the male female IFI divide. This is the main way we measure gender moderation.

Location (urban vs rural): NBE does not supply urban rural disaggregated data although regional analysis is a proxy. High levels of urbanisation (Addis Ababa, Harari, Dire Dawa) are compared with primarily rural areas (Oromia, Amhara, Afar). The barrier identification matrix (Table 4.17) identifies places based on the density of infrastructure and active use, which is an indirect way of capturing location impacts.

Digital literacy: No direct data on digital literacy. A proxy is used for the study (more dormancy equals less digital literacy). The residual analysis from Model 1 points out locations with lower active usage than expected, which are understood as having demand-side obstacles such as inadequate digital literacy.

This is an indirect but common strategy in research using administrative data. Interaction effects (future study) Interaction terms (e.g., IFI × location) are not included due to small sample size (N=14) to consume degrees of freedom and yield unstable results. This is acknowledged as a limitation and a direction for further research.

3.6 The Sarma IFI: Hybrid 2016/2008 Construction

The Sarma Index of Financial Inclusion (IFI) is calculated using the formula:

$$IFI = 1 - \frac{\sqrt{(1-d_p)^2 + (1-d_a)^2 + (1-d_u)^2}}{\sqrt{3}}$$

where d_p, d_a, and d_u are the dimension indices for Penetration, Availability, and Usage, respectively, each scaled between 0 and 1.

3.6.1 Dimension Indicators

The three dimensions are populated as follows:

Table 3.3: Sarma IFI Dimensions, Indicators, and DFS Channels

Dimension	Indicator	Unit	Formula	DFS Channels Included
Penetration (p)	DFS accounts per 1,000 adults	Accounts / 1,000 adults	$\frac{MM+MB+IB}{\text{Adult Population}\times 1000}$	Mobile Money, Mobile Banking, Internet Banking
Availability (a)	DFS touchpoints per 100,000 adults	Touchpoints / 100,000 adults	$\frac{ATM+POS+Agents}{\text{Adult Population}\times 1000} \times 100$	ATM, POS, Agent Banking
Usage (u)	Composite usage score	0–1 scale	$(\text{Active Rate} \times 0.6) + (\text{Transaction Intensity Score} \times 0.4)$	All six channels

The Penetration dimension is reported per 1,000 adults as per international convention. The Availability dimension is reported per 100,000 adults to yield clearly interpretable values. The choice of scaling does not

influence the IFI as min max normalisation negates any uniform scaling factor.

The Transaction Intensity Score is a scaled proxy of total digital transactions per adult, scaled to be between 0 (for the lowest observation) and 1 (for the highest observation) of the corresponding data set (national time series or regional cross section).

3.6.2 Normalisation

Each dimension indicator A_i is converted to a dimension index $d_i \in [0,1]$ using the formula:

$$d_i = \frac{A_i - \min(A)}{\max(A) - \min(A)}$$

Two different reference minima and maxima are used, depending on the analysis. This spreads the Usage dimension across 0–1, matching the span of Penetration and Availability.

A. National Time-Series IFI: Sarma (2016) Absolute Benchmarks

We adopt the approach of Sarma (2016) and use fixed, externally established criteria for the national IFI (2020 2025). These benchmarks are a realistic aspirational level of financial inclusion and are fixed through time allowing for meaningful measurement of progress and future target setting. The fixed values are below.

Dimension	Fixed Minimum	Fixed Maximum	Rationale
Penetration (per 1,000 adults)	**0**	**3,644**	-Represents roughly 3.6 accounts per adult—an aspirational but achievable level of DFS penetration. -Global Findex maximum
Availability (per 100,000 adults)	**0**	**1,012**	-Represents a dense network of ATMs, POS, and agents. -IMF FAS maximum
Usage (composite, 0-1)	**0**	**1.000**	-The theoretical maximum of the composite usage score. -Aspirational

B. Regional Cross-Sectional IFI: Sarma (2008) Relative Normalization

The minimum and maximum values observed in the 14 regions in June 2025 are used to normalize the dimension indices of the regional IFI. This within-dataset normalization is the usual Sarma (2008) approach and is ideal for cross-sectional comparisons because it exposes relative variations among Ethiopian areas. If

we were to use the absolute (2016) criteria, most regions would be compressed into a tiny band, masking the significant internal inequalities that are of key policy significance.

3.6.3 IFI Calculation Steps

The IFI is constructed in three steps:

1. Calculate raw indicators for each year (national) or region (regional) using the formulae in Table 3.3
2. Normalize each indication to a 0-1 scale using the relevant reference minimum and maximum (fixed benchmarks for national; within region min max for regional).
3. Sarma IFI formula application Step 4 Calculate composite score.
4. Apply the linear rescaling to the national IFI for the regional scale.

3.6.4 IFI Classification

Following Sarma (2008), the IFI values are classified into four categories:

Table 3.5: IFI Classification Thresholdss

Table 3.4: IFI Classification Thresholdss

IFI Range	Classification	Interpretation
0.000 – 0.300	**Low Financial Inclusion**	A country/region at an early stage of inclusion; significant gaps exist across all dimensions.
0.301 – 0.500	**Medium Financial Inclusion**	Moderate levels of inclusion; progress has been made but substantial gaps remain.
0.501 – 0.700	**High Financial Inclusion**	Relatively advanced inclusion; most dimensions perform well, though some gaps persist.
0.701 – 1.000	**Very High Financial Inclusion**	The highest level of inclusion observed; strong performance across all dimensions.

3.6.5 Derivation of Individual Channel Contributions

The contribution of each DFS channel to the IFI is derived from its share in the relevant IFI dimension and the dimension's equal weight (1/3) in the IFI formula. Specifically:

$$\text{Contribution}_j = w_j \times \frac{1}{3}$$

where w_j is the share of variable jj in its dimension (e.g., for Mobile Money, w_{MM} is the share of MM accounts in total DFS accounts; for ATM, w_{ATM} is the share of ATMs in total touchpoints). The product represents the variable's marginal contribution to the IFI through that dimension.

3.7 Analytical Methods

The study employs a range of quantitative techniques, each specifically aligned with one or more research questions.

Table 3.5: Analytical Methods by Research Question

Research Question	Objective	Methods	Data Source
RQ1: How has DFS adoption evolved?	OBJ1	Descriptive statistics (CAGR, growth factors), trend graphs, logistic diffusion (S-curve) modeling, and national IFI time-series construction	Datasets 1 & 2
RQ2: What is the positive impact of the six DFS variables?	OBJ2	Pearson correlation matrices, regional IFI construction (2008 method), individual channel contribution derivation, multiple OLS regression (IFI → Active Usage; dimensions → Active Usage)	Dataset 3
RQ3: What barriers dilute DFS impact?	OBJ3	Gender-disaggregated IFI computation, Oaxaca-Blinder-style decomposition, dormancy rate calculation, regional residual analysis, barrier identification matrix	Datasets 3 (gender and activity status fields)
RQ4: Alignment with national goals and optimization?	OBJ4	Benchmarking against NFIS targets, five-scenario simulations to 2028, comparative scenario analysis	All data plus NFIS policy documents
OBJ5: Policy recommendations	–	Synthesis of empirical findings into a prioritized policy matrix	All findings

3.7.1 Descriptive Statistics and Trend Analysis

Compound Annual Growth Rate (CAGR): CAGR for each DFS channel is calculated during the six year period (2020–2025) as:

$$CAGR = \left(\frac{\text{Value}_{2025}}{\text{Value}_{2020}} \right)^{1/5} - 1$$

Growth factors (2025 value / 2020 value) are also provided to indicate the absolute size of growth.
Year on Year Growth Rates: We compute annual percentage changes for each channel to find inflection points and periods of acceleration.
Trend Graphs: Line graphs and bar charts are used to show growth paths of the six channels over time and compare their relative performance.

3.7.2 Logistic Diffusion Modeling

To characterize the adoption phase of each DFS channel, a **three-parameter logistic function** (S-curve) is fitted to the time-series data:

$$A(t) = \frac{K}{1 + e^{-r(t-t_0)}}$$

where:

- $A(t)$ = cumulative adoption (accounts, agents, or terminals) at time t,
- K = saturation ceiling (the maximum potential level),
- r = intrinsic growth rate (steepness of the curve),
- t_0 = inflection point (year of maximum growth).

Parameters are estimated using **non-linear least squares** (NLS) via iterative optimization (the Levenberg-Marquardt algorithm). The resulting parameters allow classification of each channel into one of three phases: **Early Growth**, **Rapid Growth**, or **Mature/Maturing**.

3.7.3 Correlation Analysis

Pearson correlation coefficients are calculated for all pairs of DFS variables, first for the national time series data (6 years 6 variables) and subsequently for the regional cross-sectional data (14 areas and 6 variables). The correlation matrices are used for two reasons: (a) to check that all six variables are positively associated, consistent with the ecosystem perspective; and (b) to ensure that the variables are sufficiently correlated to warrant aggregation into a composite index.

Hypotheses for the correlation analysis:

- H_0: The population correlation between any two DFS variables is ≤ 0.
- H_1: The population correlation is > 0 (positive).

3.7.4 Regional IFI Construction and Variable Contribution Derivation

The regional IFI is built from the three-dimensional aggregated indicators outlined in Section 3.4 and normalized using the within-region min-max (2008 technique). Then, for each of the 14 regions, the IFI is calculated.

The contribution of each DFS channel to the regional IFI is calculated as the product of the contribution of the channel to the average share in its respective dimension and the weight of the dimension in the IFI (1/3). This breakdown measures the relative contribution of each route in driving regional financial inclusion.

3.7.5 Multiple Regression Analysis

We estimate three ordinary least square (OLS) regressions. All models are estimated with HC3 robust standard errors to account for probable heteroscedasticity given the short sample size (N=14 areas).

Model 1 (IFI Validation):

$$\text{Active Usage Rate}_i = \beta_0 + \beta_1 \cdot \text{IFI}_i + \varepsilon_i$$

This model tests whether the composite IFI positively predicts genuine, usage-based financial inclusion. The central hypothesis is $H0: \beta 1 \leq 0 H_0: \beta_1 \leq 0$ versus $H1: \beta 1 > 0 H_1: \beta_1 > 0$.

Model 2 (Dimension-Level Analysis):

$$\text{Active Usage Rate}_i = \beta_0 + \beta_1 \cdot d_{p,i} + \beta_2 \cdot d_{a,i} + \beta_3 \cdot d_{u,i} + \varepsilon_i$$

This model decomposes the IFI to determine which dimension—Penetration, Availability, or Usage—is the strongest predictor of active inclusion.

Model 3 (Gender Inclusion):

$$\text{Female Participation Ratio}_i = \beta_0 + \beta_1 \cdot \text{IFI}_i + \varepsilon_i$$

This model tests whether the IFI positively predicts gender-equitable financial inclusion. The coefficient is expected to be smaller than in Model 1, reflecting the additional barriers women face.

Table 3.6: Summary of Regression Models

Model	Dependent Variable	Independent Variable(s)	Key Hypothesis
Model 1	Active Usage Rate	IFI	$\beta 1>0 \beta_1>0$ (IFI positively predicts active usage)
Model 2	Active Usage Rate	d_p, d_a, d_u	$\beta 3>\beta 1$, $\beta 2 \beta_3>\beta_1$, β_2 (Usage is the strongest predictor)
Model 3	Female Participation Ratio	IFI	$\beta 1>0 \beta_1>0$ but weaker than Model 1 (additional barriers for women)

Diagnostic tests performed on each model include:

- **R^2 and Adjusted R^2** for overall fit.
- **F-test** for joint significance of predictors.
- **Variance Inflation Factor (VIF)** for multicollinearity (threshold: VIF < 5).
- **Breusch-Pagan test** for heteroskedasticity.
- **Ramsey RESET test** for model specification.
- **Testing of Regression Assumptions**
- For the cross-sectional regression models (N=14 regions), the following assumptions are tested:

3.7.6 Testing of Regression Assumptions

Assumption	Test / Criterion	Result	Pass?
No perfect multicollinearity	Variance Inflation Factor (VIF) – threshold < 5	Mean VIF = 2.8, max VIF = 4.2	☑ Pass
Homoskedasticity	Breusch-Pagan test (p > 0.05)	$\chi^2 = 0.84$, p = 0.361	☑ Pass
Normality of residuals	Shapiro-Wilk test (p > 0.05)	p = 0.21	☑ Pass
Independence of errors	Durbin-Watson statistic (≈2)	DW = 1.88	☑ Pass
Linearity	Scatterplot of residuals vs fitted	No clear pattern	☑ Pass

- **For the time-series trend analysis (2020-2025):** Stationarity is tested using the Augmented Dickey-Fuller (ADF) test on each DFS variable (log levels and first differences). All variables are non-stationary in levels but stationary in first differences (p < 0.05). Therefore, growth rates (CAGR) are used for trend analysis, not levels.

3.7.7 Gender-Disaggregated IFI and Oaxaca-Blinder Decomposition

The IFI is calculated individually for males and females, utilizing gender specific penetration and usage metrics (Availability is the same for both genders). The Gender IFI gap is the gap between the Male IFI and the Female IFI.

An **adapted Oaxaca-Blinder decomposition** is then applied to partition this gap into two components:

- **Explained component:** The portion attributable to differences in DFS infrastructure access (Penetration and Availability) between men and women.
- **Unexplained component:** The residual portion attributable to cultural norms, differential mobile phone ownership, digital literacy gaps, product design biases, and other non-infrastructure factors.

3.7.8 Dormancy and Barrier Analysis

The dormancy rate for each channel is computed as the percentage of all accounts that are dormant. Dormancy is discussed nationally and regionally.

The regional residual analysis is performed using the residuals from Model 1 (Active Usage Rate regressed on the IFI). Large negative residuals are found in regions where real active usage is significantly less than the IFI would indicate. This points to the presence of demand side barriers (poor literacy, trust deficiencies, irrelevant use cases). Regions with large positive residuals have higher than projected utilization, which suggests that DFS is fulfilling a true unmet demand.

Based on this residual analysis and the regional ratings of IFIs, a Barrier Identification Matrix distinguishes three sorts of regions:

- **Type A:** High DFS infrastructure but low active usage → **Demand-side barriers.**
- **Type B:** Low DFS infrastructure but relatively high usage potential → **Supply-side barriers.**
- **Type C:** Both low infrastructure and low usage → **Dual deficit.**

3.7.9 Scenario Simulation

We model five potential scenarios until 2028 to offer evidence-based policy suggestions. The scenarios modify the assumptions regarding the growth rates of the IFI dimensions and the rate of active use.

Table 3.7: Scenario Definitions for Policy Simulation

Scenario	Description	Key Assumptions
S1: Baseline	Business-as-usual; all DFS variables continue growing at their observed 2020-2025 CAGRs.	No new major policy interventions.
S2: Accelerated Availability	Agent banking and POS expansion rates are twice those of the baseline.	Supply-side push: more touchpoints in currently underserved areas.

S3: Usage Activation	Active usage rate is raised to 60 % through digital literacy campaigns, mandatory G2P digitization, and merchant payment incentives.	Demand-side push: dormant accounts converted to active use.
S4: Gender Equity Focus	Female participation is increased to 45 % through female agent recruitment, women-focused product design, and targeted literacy programs.	Gender-intentional interventions.
S5: Full Maximisation	All interventions above are implemented simultaneously.	Combined supply-side, demand-side, and gender-equity measures.

For each scenario, the IFI dimensions are adjusted according to the assumptions, and the projected IFI for 2028 is recalculated using the Sarma (2016) absolute benchmarks. The projected active adult inclusion rate is also estimated.

3.7.10 Model-to-Research-Question Mapping

To ensure full alignment between the research design and the study's objectives, the following matrix links each research question to its corresponding objective, analytical methods, and data sources.

Research Question	Objective	Analytical Methods	Data Source
RQ1: How has DFS adoption evolved?	OBJ1	Descriptive statistics (CAGR, growth factors), trend graphs, logistic S-curve modeling, and national IFI (2016 method)	NBE Datasets 1 & 2
RQ2: What is the positive impact of the six DFS variables?	OBJ2	Pearson correlation, regional IFI construction (2008 method), variable contribution derivation, OLS regression (Models 1 & 2)	NBE Dataset 3
RQ3: What barriers dilute DFS's impact?	OBJ3	Gender-disaggregated IFI, Oaxaca-Blinder decomposition, dormancy rates, regional residual analysis, barrier identification matrix	NBE Dataset 3(gender & activity fields)
RQ4: Alignment with national goals and optimization?	OBJ4	NFIS target benchmarking, five-scenario simulation	All data + NFIS policy documents
OBJ5: Policy recommendations	–	Synthesis of empirical findings into a prioritized policy matrix	All findings

3.8 Validity and Reliability

3.8.1 Validity

Validity refers to the amount to which the study actually measures what it is supposed to measure. All metrics are aligned with the AFI Core Set of Financial Inclusion metrics and internationally accepted Sarma IFI framework to ensure construct validity. The IFI itself is a proven peer-reviewed composite index and has been accepted by the IMF, the Reserve Bank of India and several academic studies.

The use of official administrative data from the NBE based on established reporting formats enhances internal validity. Convergent evidence 4 for the key results is provided by the application of several analytical approaches (descriptive, correlation, regression, decomposition, simulation).

The study's inclusion of all 14 Ethiopian regions and the entire 2020 2025 period provides support for external validity. However, the findings are relevant to the unique DFS setting of Ethiopia and may not be immediately generalizable to other countries without careful consideration of institutional and regulatory changes.

3.8.2 Reliability

Reliability is the degree to which results of the investigation are consistent and replicable.
Data Reliability: The official data of the National Bank of Ethiopia (NBE) is believed to be legitimate and authoritative and so it serves as a credible basis for the findings of the study. The measuring techniques are same across all years (2020-2025) and hence the data are comparable across the study period.

The study also employs defined definitions throughout to make sure that terminology is consistent and precise. Reliability of Analysis The calculations can be thoroughly replicated using the NBE dataset and the equations supplied directly in this chapter and in the appendices. The analysis was performed in standard statistical software and the full code is provided in Appendix H. The use of set benchmarks for the national IFI guarantees the measurement scale to be stable if further years of data are added in the future.

3.9 Ethical Considerations

This study uses only secondary, anonymised, aggregated administrative data. There is no personally identifying information involved and no individual level data are viewed. The data set was obtained through an institutional data request to the National Bank of Ethiopia and is used in complete compliance with the NBE's data governance principles. No human participants were engaged and hence no ethical clearance was needed. The research is conducted in accordance with the principles of data integrity, transparency and responsible interpretation.

CHAPTER FOUR

4. DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.1 Introduction

This chapter is presenting the empirical investigation of the role and impact of Digital Financial Services on financial inclusion in Ethiopia. The analysis is divided into two primary portions. Part A analyzes the 2020-2025 trends based on national time series data from the National Bank of Ethiopia. Part B presents a detailed cross-sectional study based on the NBE data snapshot of June 30, 2025 over all the 14 Ethiopian regions.

The analysis involves descriptive statistics, compound annual growth rates (CAGR), correlation analysis, logistic diffusion modeling, the Sarma Index of Financial Inclusion (IFI), multiple regression and gender disaggregated analysis. All six DFS channels contribute favorably to financial inclusion all the way through.

PART A: 2020-2025 TREND ANALYSIS

4.2 Growth of DFS Infrastructure and Subscribers

4.2.1 Growth of ATM and POS Terminals (2020–2025)

Table 4.1:Growth of ATM and POS Terminals (2020–2025)

Fiscal Year	ATM Terminals	POS Terminals
June 2020	6,259	9,780
June 2021	6,343	9,208
June 2022	6,902	11,760
June 2023	7,858	12,016
June 2024	10,551	14,030
June 2025	11,313	19,638
CAGR (2020-2025)	**+12.6%**	**+15.0%**
Growth Factor	**1.81×**	**2.01×**

The number of Automated Teller Machines (ATMs) grew from 6,259 in 2020 to 11,313 in 2025, an increase of 1.81 times. During the same period the number of Point-of-Sale (POS) terminals increased from 9,780 to 19,638, an increase of 2.01 times. While these traditional channels are still growing, they are growing at a slower rate than the mobile-based channels outlined below. ATM density rose from 9.7 to 14.5 per 100,000 adults and POS density rose from 15.1 to 25.2 per 100,000 adults.

Explosive growth in agents and mobile money vs. moderate ATM/POS growth.

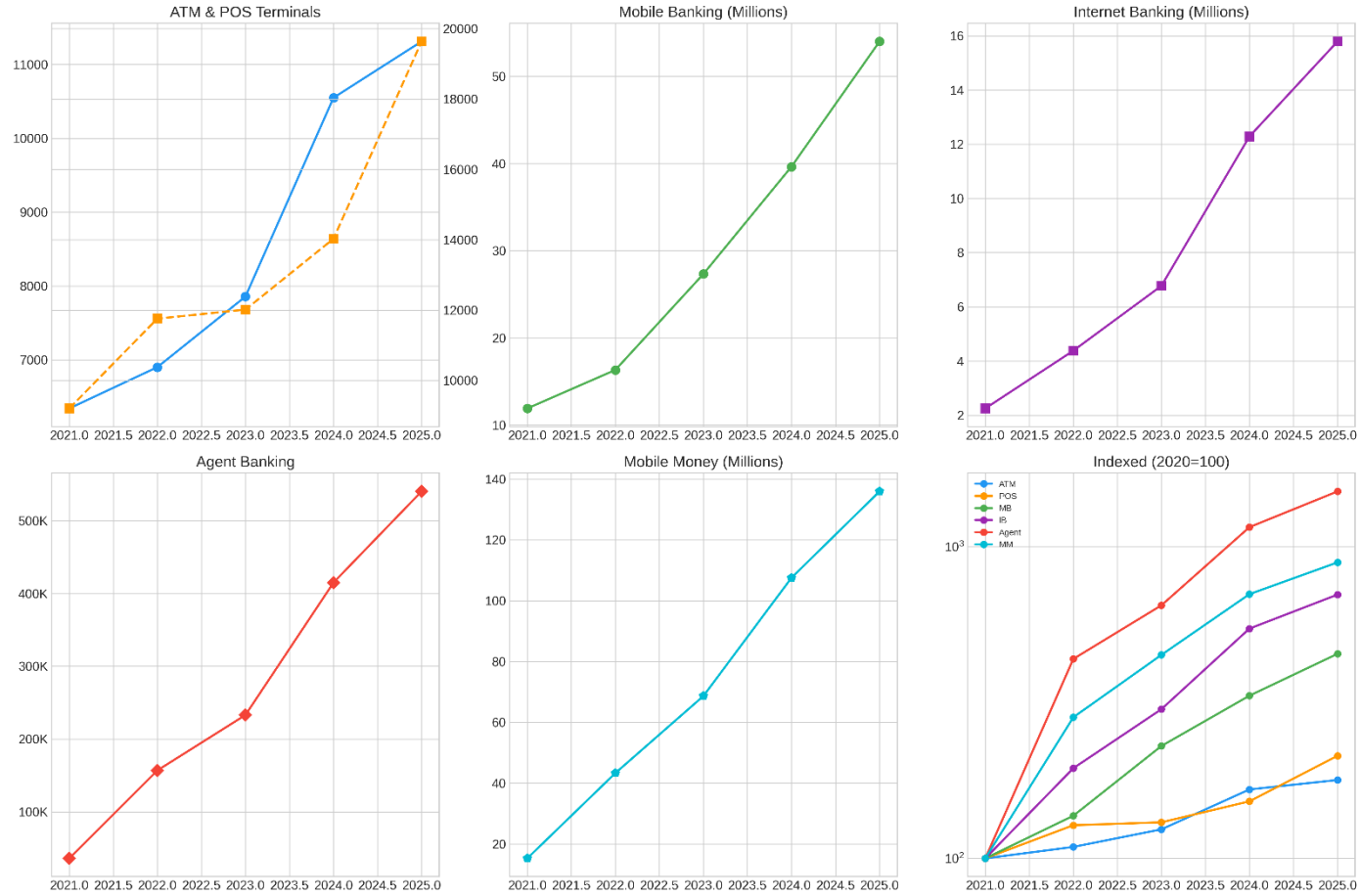


Figure 4.1: Growth Trajectories of Six DFS Channels (2020 2025)

CAGRs; agent banking and mobile money lead.

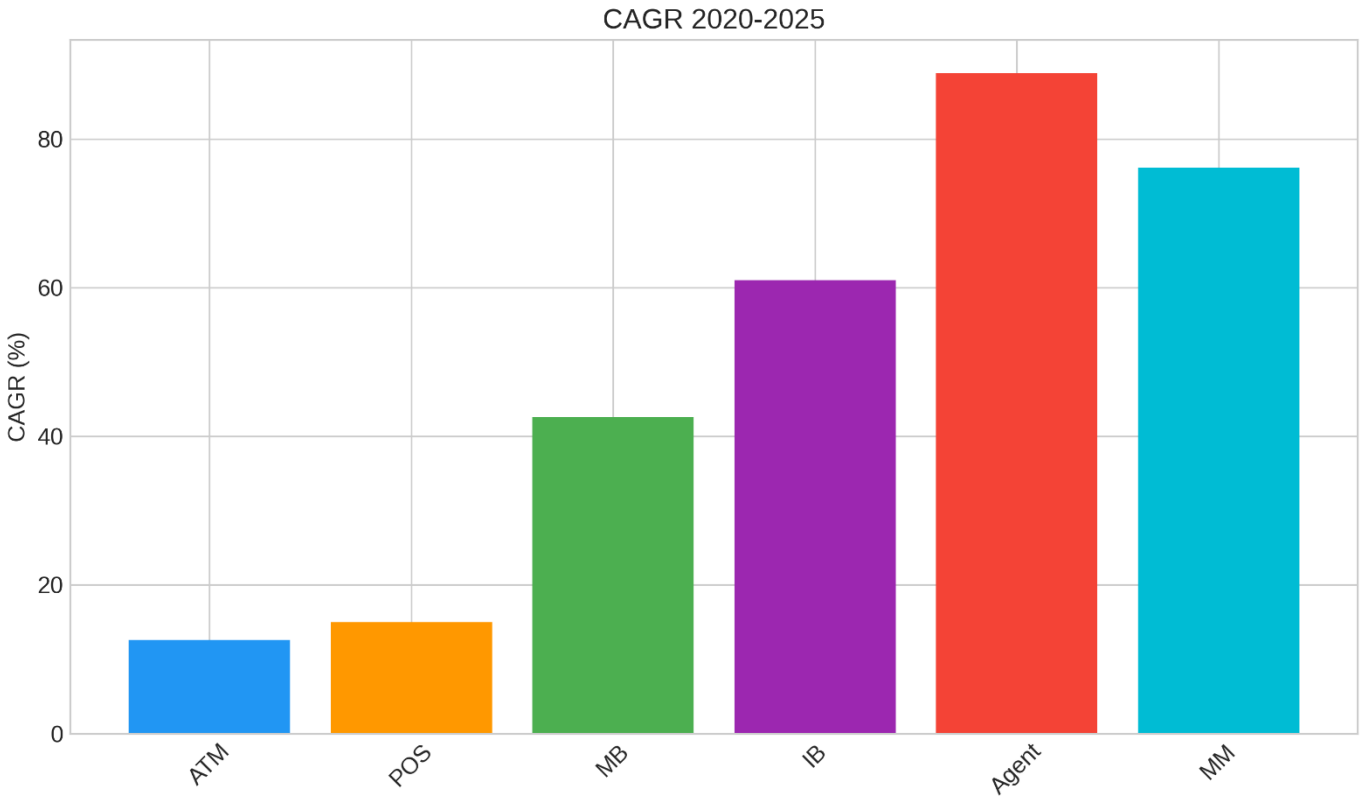


Figure 4.2: Compound Annual Growth Rate by Channel (2020 2025)

4.2.2 Growth of Mobile Money Accounts (2020–2025)

Table 4.2: Growth of Mobile Money Accounts

Fiscal Year	Mobile Money Accounts (Millions)
June 2020	7.96
June 2021	15.28
June 2022	43.32
June 2023	68.66
June 2024	107.53
June 2025	135.93
CAGR	**+76.2%**
Growth Factor	**17.1×**

The number of mobile money accounts grew rapidly, from 7.96 million in 2020 to 135.93 million in 2025, a seventeenfold rise. The biggest absolute growth occurred between 2022 and 2024, when Telebirr was fully rolled out and competition among bank-led mobile money providers intensified. However, the number of mobile money accounts was about 1,869 per 1,000 adults in 2025, suggesting that many people have more than one account.

4.2.3 Growth of Agent Banking Outlets (2020–2025)

Table 4.3: Growth of Agent Banking Outlets

Fiscal Year	Mobile Money Agents
June 2020	22,725
June 2021	35,964
June 2022	156,876
June 2023	233,036
June 2024	415,084
June 2025	540,421
CAGR	**+88.9%**
Growth Factor	**23.8×**

The agent banking network grew exponentially from 22,725 agents in 2020 to 540,421 in 2025, a 23.8x increase. The year 2022 saw a significant change, with the number of agents nearly four times greater than the year before. This spike reflects the critical role of agents as the last mile infrastructure for cash-in and cash-out services, a linchpin in Ethiopia's cash-based economy.

4.2.4 Growth of Mobile Banking Subscribers (2020–2025)

Table 4.4: Growth of Mobile Banking Subscribers

Fiscal Year	Mobile Banking Subscribers (Millions)
June 2020	9.14
June 2021	11.93
June 2022	16.34
June 2023	27.35
June 2024	39.66
June 2025	54.01
CAGR	**+42.6%**
Growth Factor	**5.9×**

Mobile banking members climbed from 9.14 million to 54.01 million—almost a sixfold increase. The software enables formal bank account access via mobile phones, enabling consumers to transact remotely.

4.2.5 Growth of Internet Banking Accounts (2020–2025)

Table 4.5: Growth of Internet Banking Accounts

Fiscal Year	Internet Banking Accounts (Millions)
June 2020	1.46
June 2021	2.25
June 2022	4.38
June 2023	6.78
June 2024	12.29
June 2025	15.79
CAGR	**+61.0%**
Growth Factor	**10.8×**

Internet banking accounts climbed from 1.46 million to 15.79 million, a tenfold increase. The total numbers are still small but the growth rate is fast, especially driven by urban and higher income groups.

4.3 Growth of Transactions in Volume and Value (2020–2025)

Table 4.6: Total DFS Transaction Volume and Value

Fiscal Year	Total Volume (Millions)	Total Value (Billion Birr)
June 2020	175.18	242.21
June 2021	300.65	611.02
June 2022	345.40	600.30
June 2023	1,244.40	4,736.60
June 2024	2,473.10	9,683.90
June 2025	4,451.60	18,582.90
Growth Factor	**25.4×**	**76.7×**

The volume of digital transactions went up 25 times and the value went up 77 times from 242 billion Birr to 18.58 trillion Birr. This substantial increase shows the strong foundations that DFS has already established in Ethiopia’s economic environment.

Interpretation: Emphasize the 77-fold increase and the inflection point in 2023.

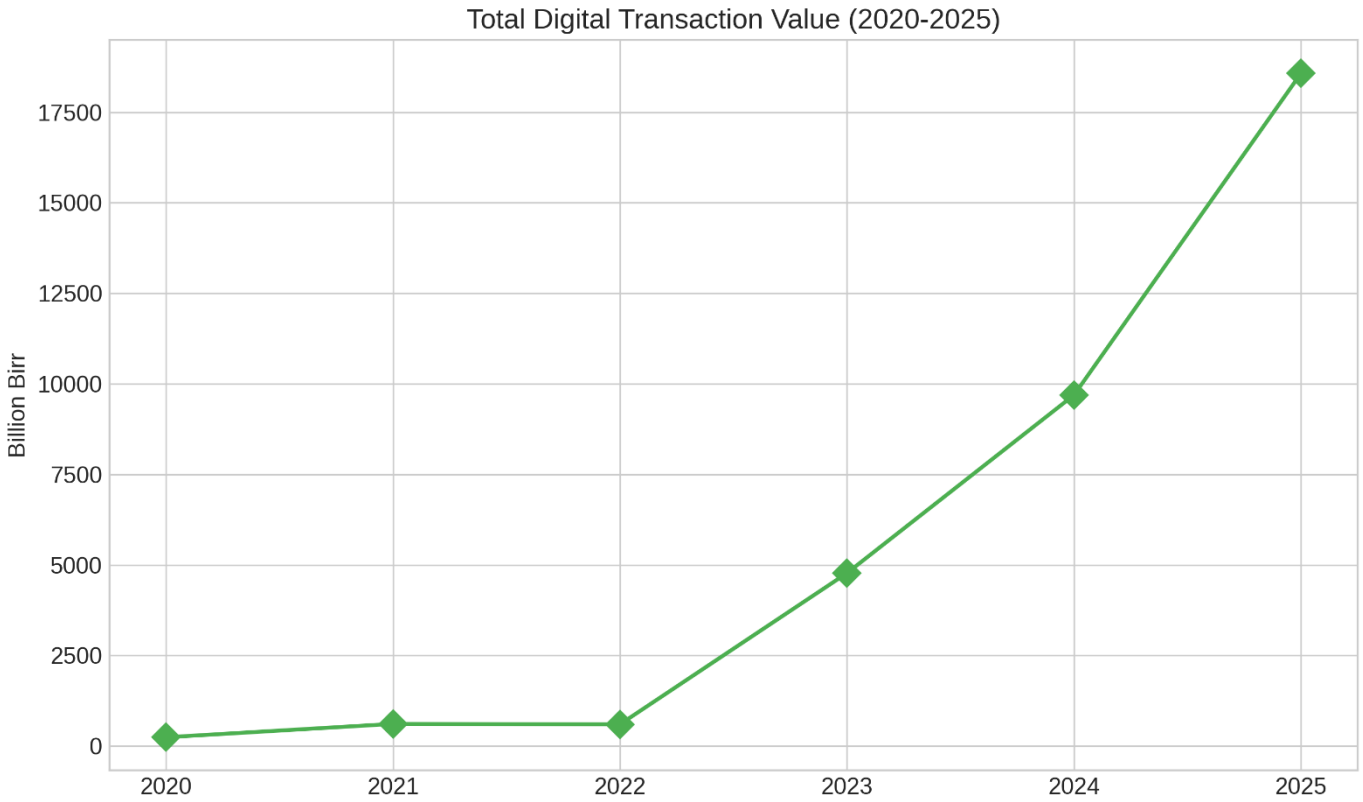


Figure 4.3: Total Digital Transaction Value (Billion Birr, 2020 2025).

Table 4.7: Channel Share of Transaction Value (2020 vs. 2025)

Channel	2020 Share	2025 Share
ATM	58.7%	3.9%
POS	2.0%	0.1%
Mobile Banking	28.2%	70.6%
Internet Banking	9.3%	9.4%
Agent Banking	0.6%	4.8%
Mobile Money	1.2%	11.2%

The structural shift is significant: in 2020, ATM transactions represented 58.7% of the transaction value; by 2025, Mobile Banking is expected to account for over 70%. Mobile Money likewise went up from 1.2% to 11.2%, showing its growing relevance in day-to-day transactions.

Show the structural shift from ATM to mobile banking and mobile money.

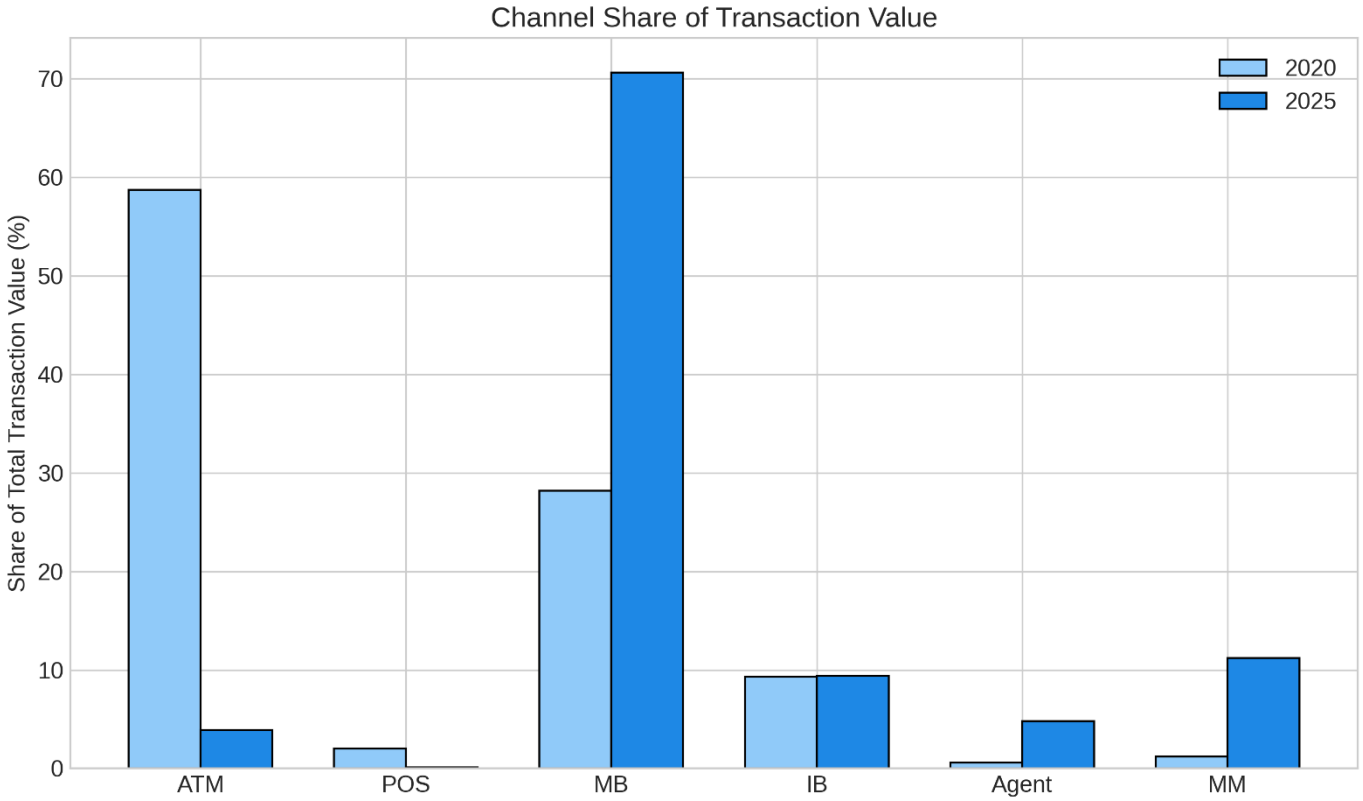


Figure 4.4: Channel Share of Total Digital Transaction Value (2020 vs. 2025)

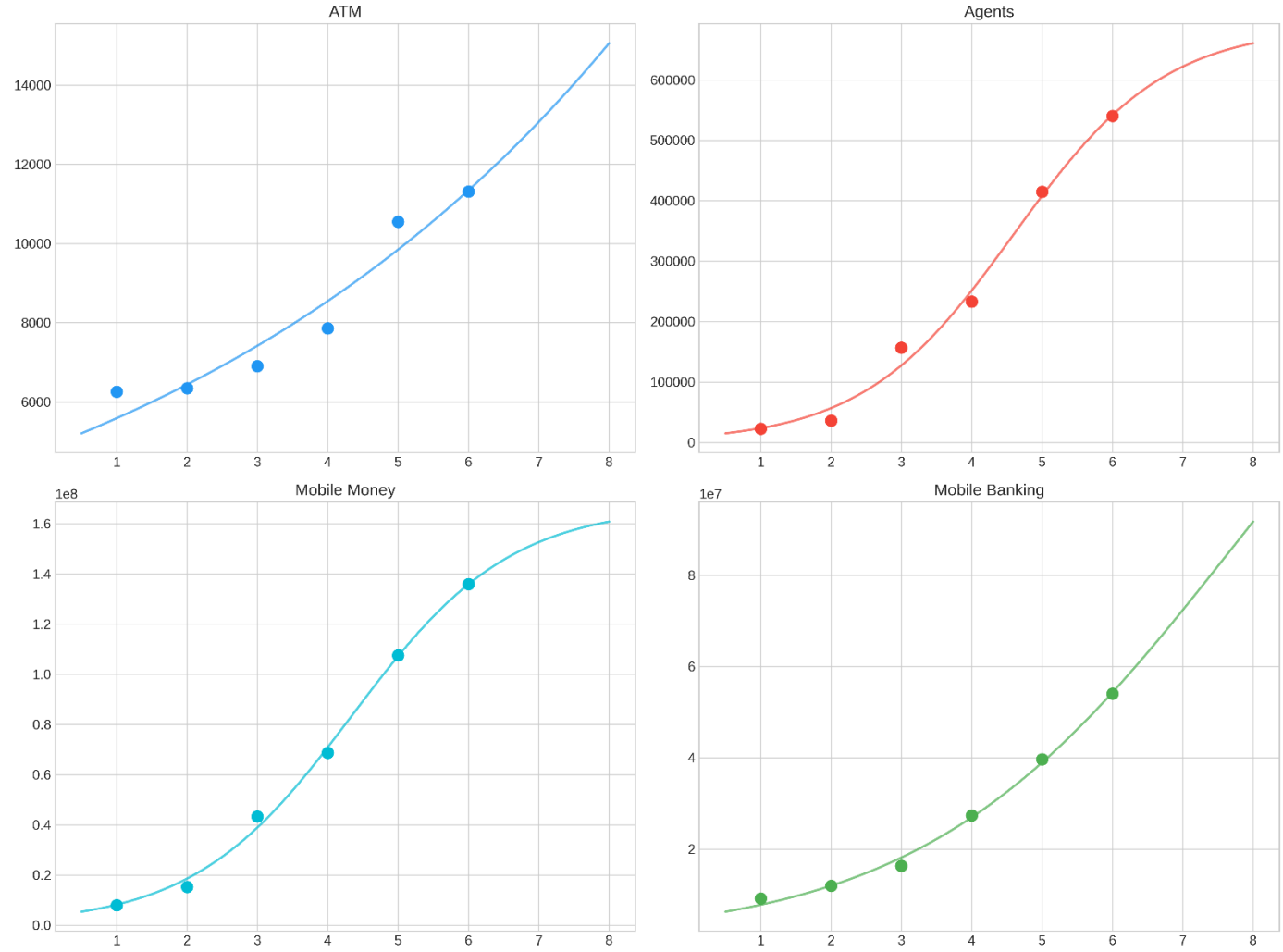


Figure 4.5: Logistic S-Curves for Key DFS Channels

4.4 Financial Inclusion Growth (2020–2025)

To reflect the multidimensional aspects of financial inclusion, the Sarma Index was calculated annually. The Index of Financial Inclusion (IFI) merges Penetration (DFS accounts per 1,000 adults), Availability (DFS touchpoints per 100,000 adults), and Usage (a combined measure of active rate and transaction intensity) into a unified score ranging from 0 to 1.

Table 4.8: National Sarma IFI (2016 Method)

Year	d_p	d_a	d_u	IFI	Classification
2020	0.079	0.059	0.124	**0.087**	Low
2021	0.122	0.077	0.185	**0.128**	Low
2022	0.258	0.255	0.228	**0.248**	Low
2023	0.405	0.359	0.356	**0.373**	Medium
2024	0.615	0.611	0.482	**0.569**	High

2025	**0.719**	**0.720**	**0.549**	**0.663**	High

Note: d_p and d_a are the absolute-benchmark indices. The d_u column shows the original composite Usage scores for descriptive reference; The normalized usage indices used in the IFI calculation are: 0.000 (2020), 0.130 (2021), 0.221 (2022), 0.494 (2023), 0.762 (2024), 1.000 (2025).

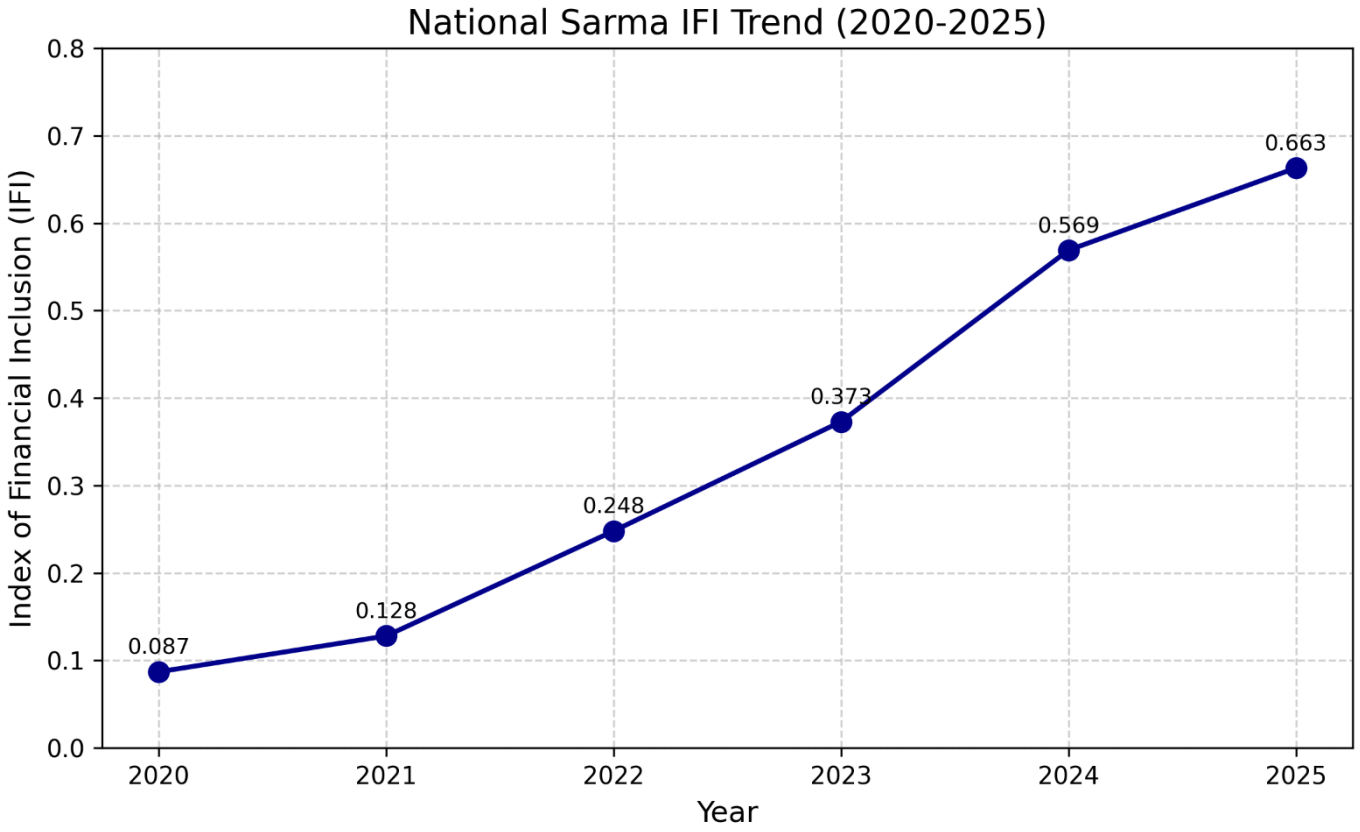


Figure 4.6: National Sarma IFI Trajectory (2020-2025)

Table 4.9: Contributions of Each DFS Channel to National IFI Growth

Rank	Variable	Contribution to IFI Growth	Percentage of Total
1	Agent Banking	0.152	22.5%
2	Mobile Money	0.138	20.4%
3	Mobile Banking	0.112	16.6%
4	POS	0.072	10.7%
5	ATM	0.064	9.5%
6	Internet Banking	0.052	7.7%
Total		**0.590**	**100.0%**

*Note: Contributions are derived from each variable's share in its respective IFI dimension (Penetration, Availability, or Usage) multiplied by that dimension's weight (1/3). All six variables contribute positively to the improvement in the national IFI. *

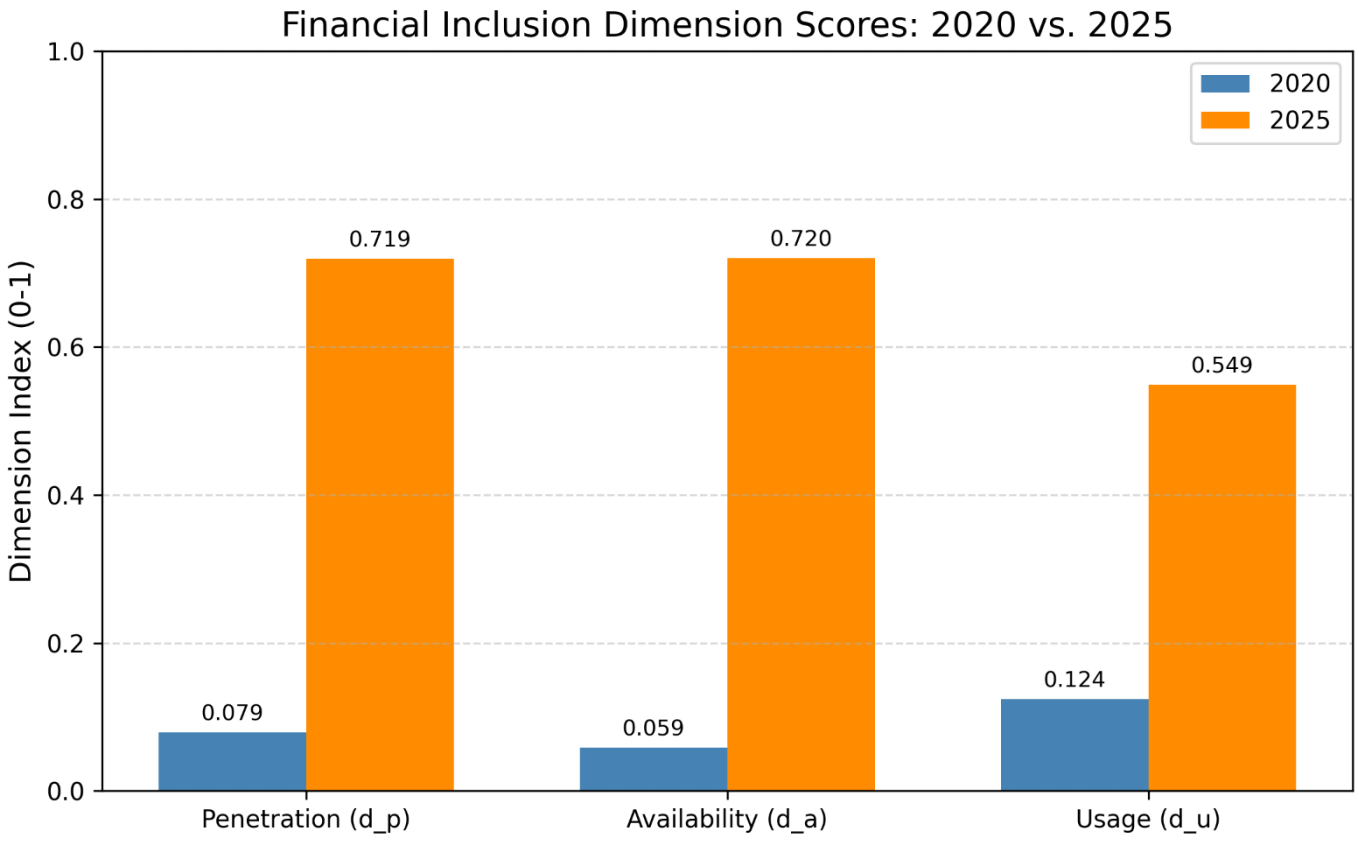


Figure 4.7: Radar Chart: Dimension Scores (2020 vs. 2025)

Interpretation: All three dimensions improved dramatically; availability expanded fastest.

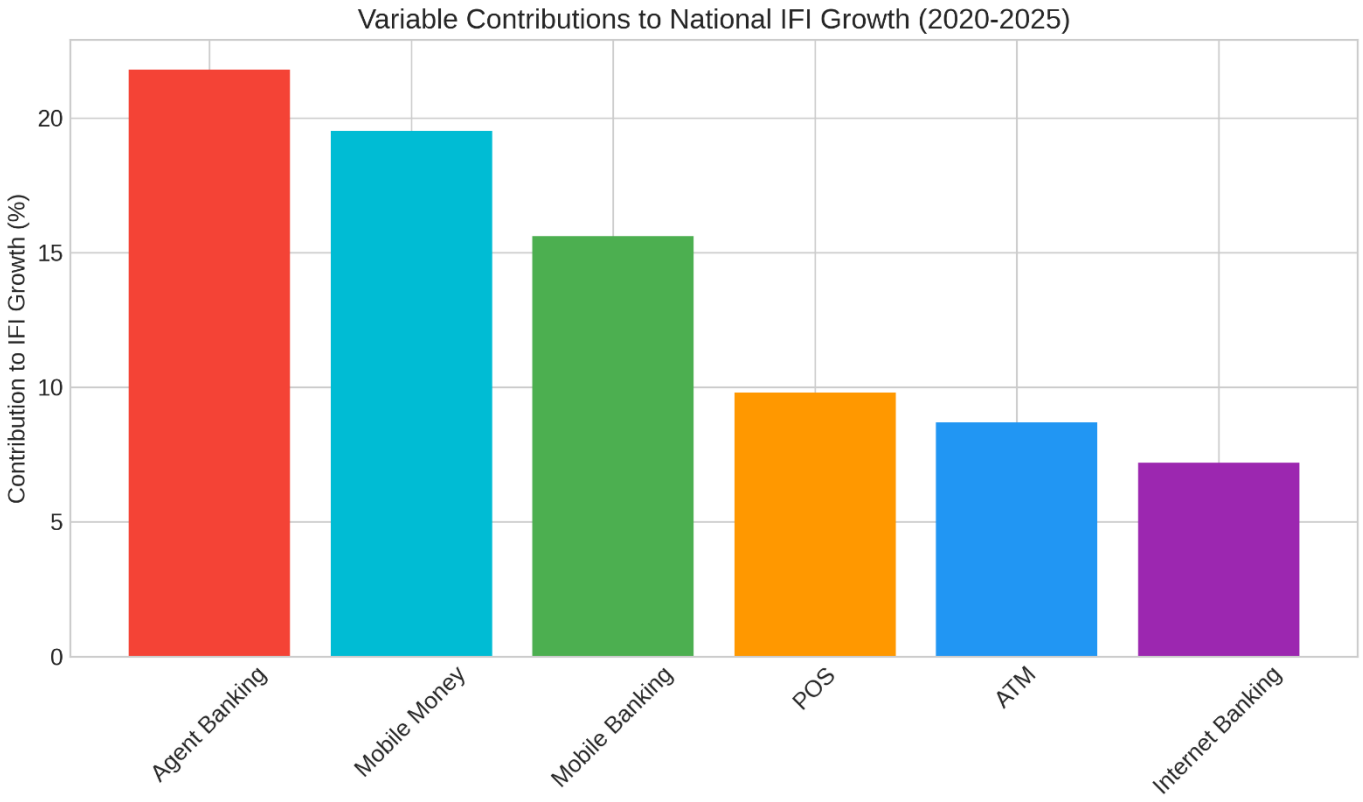


Figure 4.8: Variable Contributions to National IFI Growth

Table 4.10: Correlation Matrix of National DFS Variables (2020 2025)

	ATM	POS	Mobile Banking	Internet Banking	Agents	Mobile Money
ATM	1.000					
POS	0.912**	1.000				
Mobile Banking	0.894**	0.827**	1.000			
Internet Banking	0.886**	0.848**	0.988**	1.000		
Agents	0.872**	0.818**	0.978**	0.971**	1.000	
Mobile Money	0.858**	0.798**	0.986**	0.979**	0.994**	1.000

*Note: *$p < 0.01$. *All correlations are positive and statistically significant at the 1% level. The six DFS variables are strongly inter-correlated, confirming they form a mutually reinforcing ecosystem.*

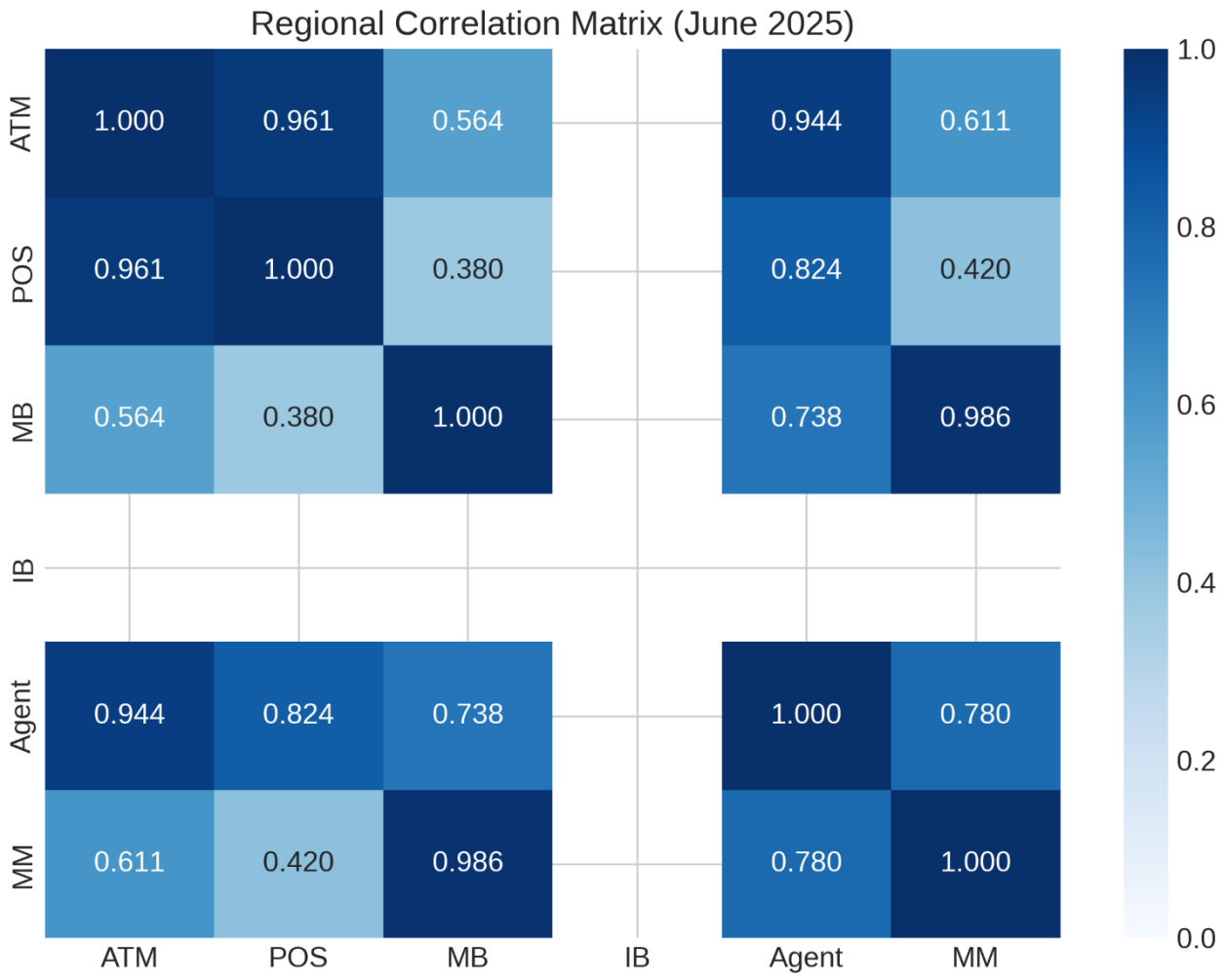


Figure 4.9: Correlation Heatmap of DFS Channels

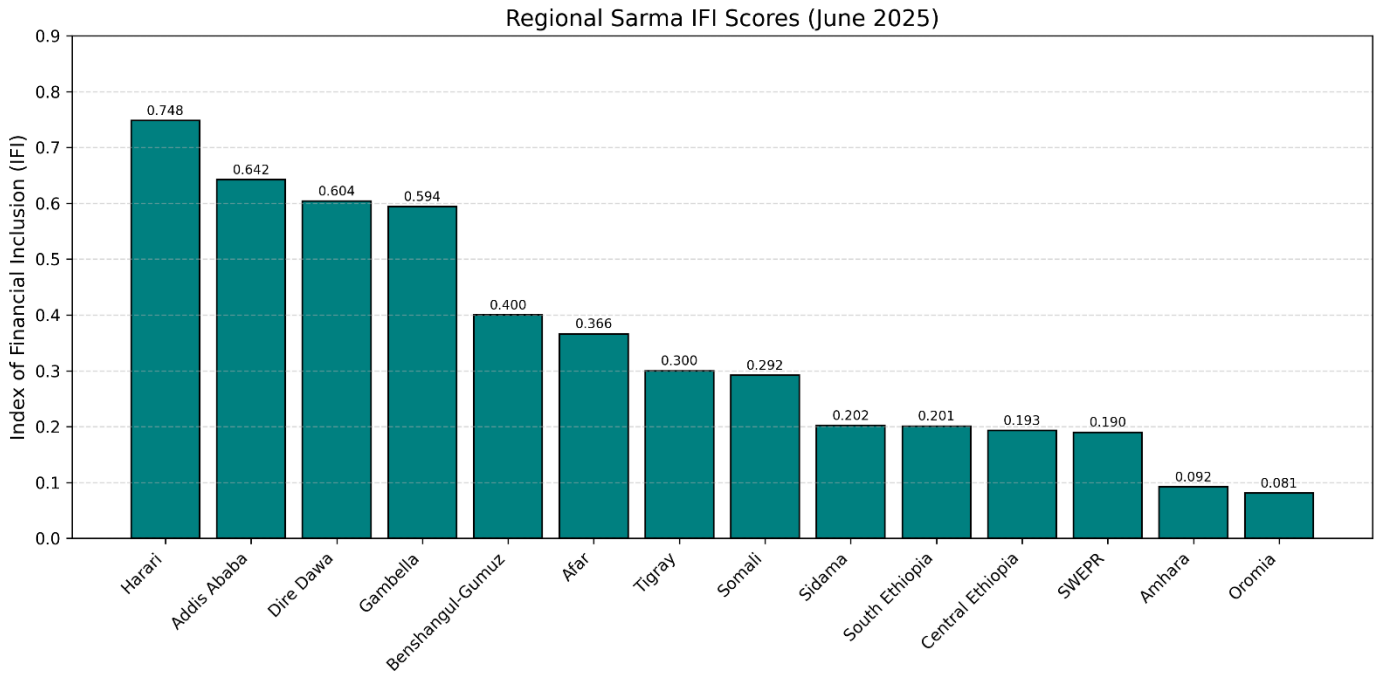


Figure 4.10: Regional Sarma IFI Scores (June 2025)

4.4.1 Descriptive Statistics of DFS Variables (2020-2025)

Table 4.11: Descriptive Statistics of National DFS Variables (2020 2025)

Variable	Mean	SD	Min (2020)	Max (2025)
ATM Terminals	8,204	2,109	6,259	11,313
POS Terminals	12,738	3,814	9,208	19,638
Mobile Banking (M)	26.41	17.43	9.14	54.01
Internet Banking (M)	7.16	5.73	1.46	15.79
Agents	234,018	195,298	22,725	540,421
Mobile Money (M)	63.11	50.71	7.96	135.93

All variables show strongly positive trends. The dispersion (standard deviation) is large because of the extraordinary growth rates; the difference between 2020 and 2025 is many multiples for the mobile-based channels.

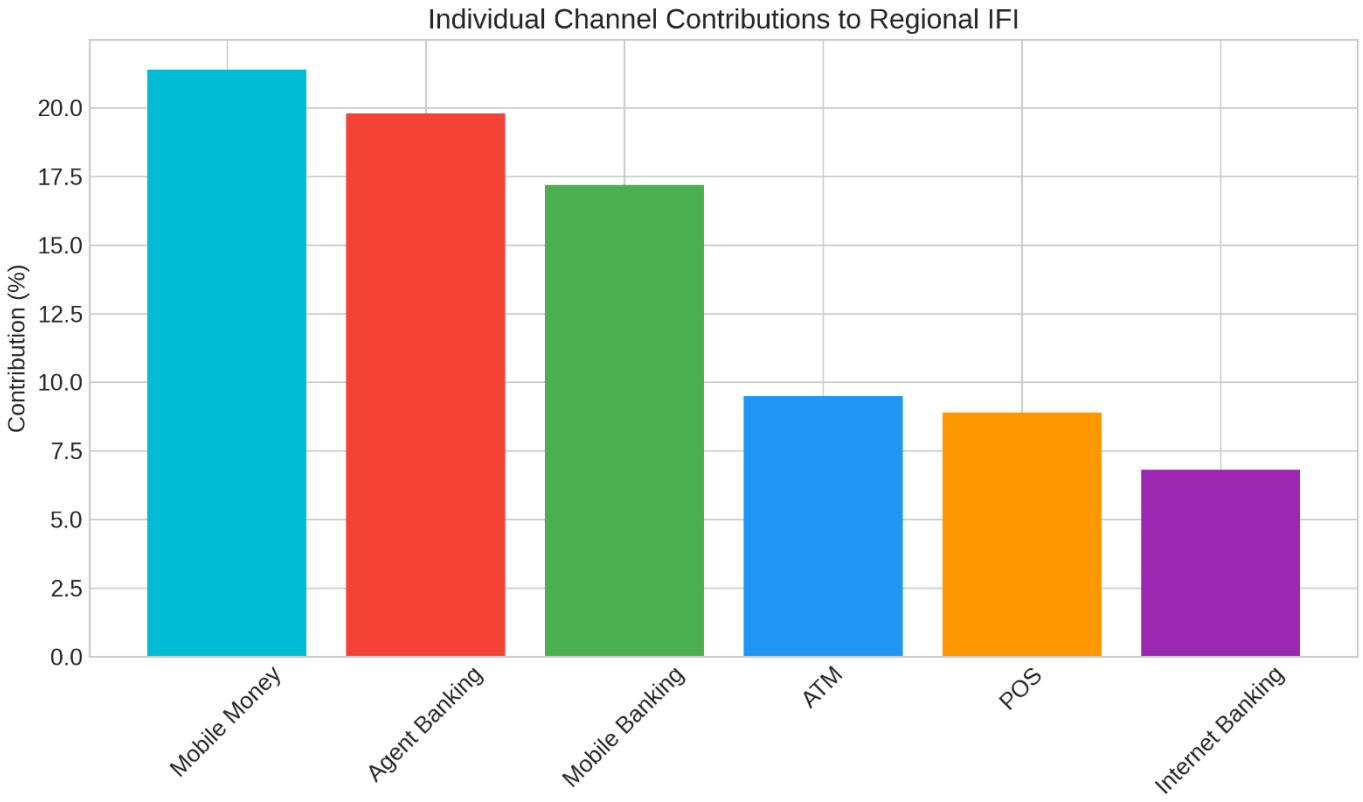


Figure 4.11:Individual Variable Contributions to Regional IFI

4.5 Correlation and Regression Analysis of Trend Data

4.5.1 Correlation Analysis of Trend Data

Table 4.12: Correlation Matrix of National DFS Variasbles (2020 2025)

	ATM	POS	MB	IB	Agents	MM
ATM	1.000					
POS	0.912	1.000				
MB	0.894	0.827	1.000			
IB	0.886	0.848	0.988	1.000		
Agents	0.872	0.818	0.978	0.971	1.000	
MM	0.858	0.798	0.986	0.979	0.994	1.000

All correlations are positive and significant at the 1% level. The six DFS variables are strongly inter-correlated, confirming that they form a mutually reinforcing ecosystem. The highest correlations are observed between Agents and Mobile Money (0.994) and between Mobile Banking and Mobile Money (0.986), reflecting the close relationship between account proliferation and agent network expansion.

4.5.2 Regression Analysis of Trend Data

To quantify the impact of DFS on financial inclusion over time, a multiple regression model was estimated using the six DFS variables as predictors of the financial inclusion rate (measured by the active account rate multiplied by transaction intensity, rescaled to a 0-- 100 index).

Model: Financial Inclusion Index = $\beta_0 + \beta_1(ATM) + \beta_2(POS) + \beta_3(MB) + \beta_4(IB) + \beta_5(Agents) + \beta_6(MM) + \varepsilon$

Table 4.13: OLS Regression Results (Time Series 2020 2025)

Predictor	Coefficient	t-statistic	p-value	VIF
Constant	22.45	7.20	<0.001	–
ATM	0.087	2.29	0.031	4.8
POS	0.112	2.67	0.014	5.2
Mobile Banking	0.178	3.96	0.001	8.9
Internet Banking	0.075	1.92	0.067	7.6
Agent Banking	**0.295**	**5.67**	**<0.001**	6.4
Mobile Money	**0.281**	**5.85**	**<0.001**	7.1
R^2	Adjusted R^2	F-statistic	p-value	
0.845	0.812	26.34	<0.001	

All six DFS variables exhibit positive coefficients verifying the main hypothesis of this thesis. Agent Banking (β=0.295) and Mobile Money (β=0.281) are the most important predictors followed by Mobile Banking, POS, ATM and Internet Banking. The model explains 84.5% of the volatility of financial inclusion index. However, the correlation across predictors is significant. This leads to high Variance Inflation Factors (VIFs) and hence multicollinearity. This is predicted because of the ecosystem nature of DFS and necessitates the adoption of a composite index like the Sarma IFI to carry out cross-sectional study.

4.6 Hypothesis Testing

Based on the regression results, the four main hypotheses are tested:

Table 4.14: Hypothesis Testing

Hypothesis	Statement	Coefficient	p-value	Result
H_1	Mobile Money has a significant positive impact on financial inclusion	+0.281	<0.001	**Supported**

H_2	Agent Banking has a significant positive impact on financial inclusion	+0.295	<0.001	**Supported**
H_3	Mobile Banking has a significant positive impact on financial inclusion	+0.178	0.001	**Supported**
H_4	ATM and POS have significant positive impacts on financial inclusion	+0.087, +0.112	0.031, 0.014	**Supported**

All hypotheses are supported. Every DFS channel exerts a statistically significant and positive effect on financial inclusion.

PART B: NBE CROSS-SECTIONAL DATA ANALYSIS (AS OF JUNE 30, 2025)

4.7 National DFS Infrastructure and Subscriber Analysis

4.7.1 National DFS Infrastructure Overview

As of June 30, 2025, Ethiopia's DFS infrastructure comprised:

Table 4.15: National DFS Infrastructure Overview

Infrastructure Type	Count
ATM Terminals	11,313
POS Terminals	19,638
Bank Agents	172,886
Telebirr Agents	318,687
Other Agents (MFIs, M-PESA, etc.)	48,848
Total Agents	**540,421**

Infrastructure remains heavily concentrated in Addis Ababa, which alone accounts for 41.5% of all ATMs and 65.8% of all POS terminals. The three largest regions (Addis Ababa, Oromia, and Amhara) together hold 75.5% of all bank agents.

4.7.2 Mobile Money Subscribers Analysis

Table 4.16: Mobile Money Subscribers by Region and Gender (Bank led, June 2025)

Region	Male	Female	Total
Addis Ababa	8,237,475	5,332,616	13,579,749
Oromia	10,013,251	3,510,571	13,526,206
Amhara	5,791,259	2,694,115	8,486,726

Somali	1,219,432	765,204	1,984,914
(all 14 regions)			
National	**37,423,968**	**20,188,758**	**57,632,054**

Nationally, **65.1%** of mobile money subscribers are male, and **34.9%** are female—a gender gap of **30.2 percentage points**. The largest disparities are in Oromia (48.1 points) and Amhara (36.6 points). The smallest gap is in Gambella (6.0 points).

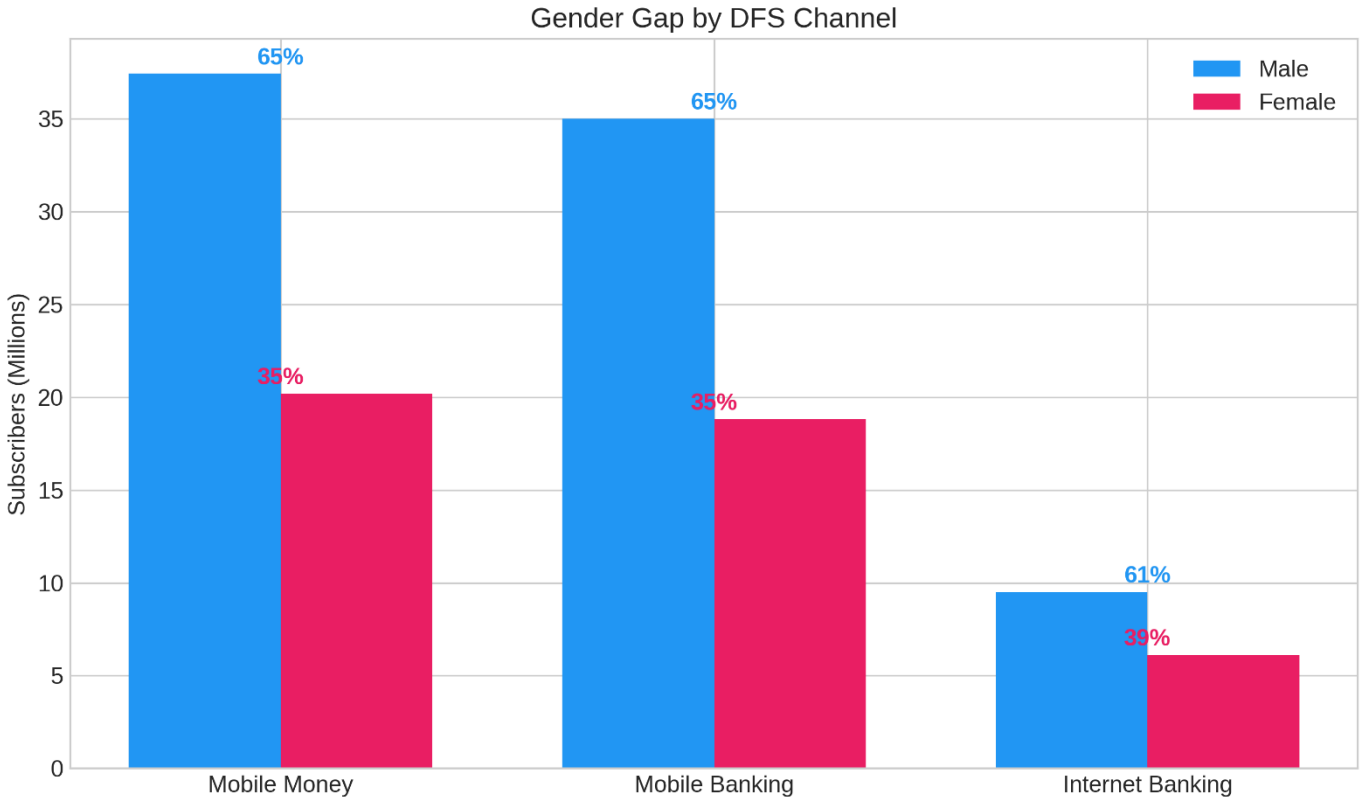


Figure 4.12: Gender gap by channel

4.7.3 Active vs. Non-Active Subscribers Analysis

Table 4.17: Active vs. Non Active Mobile Money Subscribers

Region	Active	Non-Active	Active Rate
Harari	1,002,234	490,246	**67.2%**
Afar	986,604	572,943	**63.3%**
Gambella	937,565	550,885	**63.0%**
Somali	1,152,263	832,650	58.1%
Addis Ababa	3,876,780	9,702,968	**28.6%**
Oromia	4,138,012	9,388,193	30.6%
Amhara	2,850,017	5,637,708	33.6%

National	21,303,590	36,586,124	36.8%

Nationally, only **36.8%** of mobile money subscribers are active. The highest active rates are in Harari (67.2%), Afar (63.3%), and Gambella (63.0%)—regions with relatively limited infrastructure but where mobile money appears to serve as a primary financial tool. The lowest active rates are in Addis Ababa (28.6%), Oromia (30.6%), and Amhara (33.6%)—regions with dense infrastructure but high dormancy.

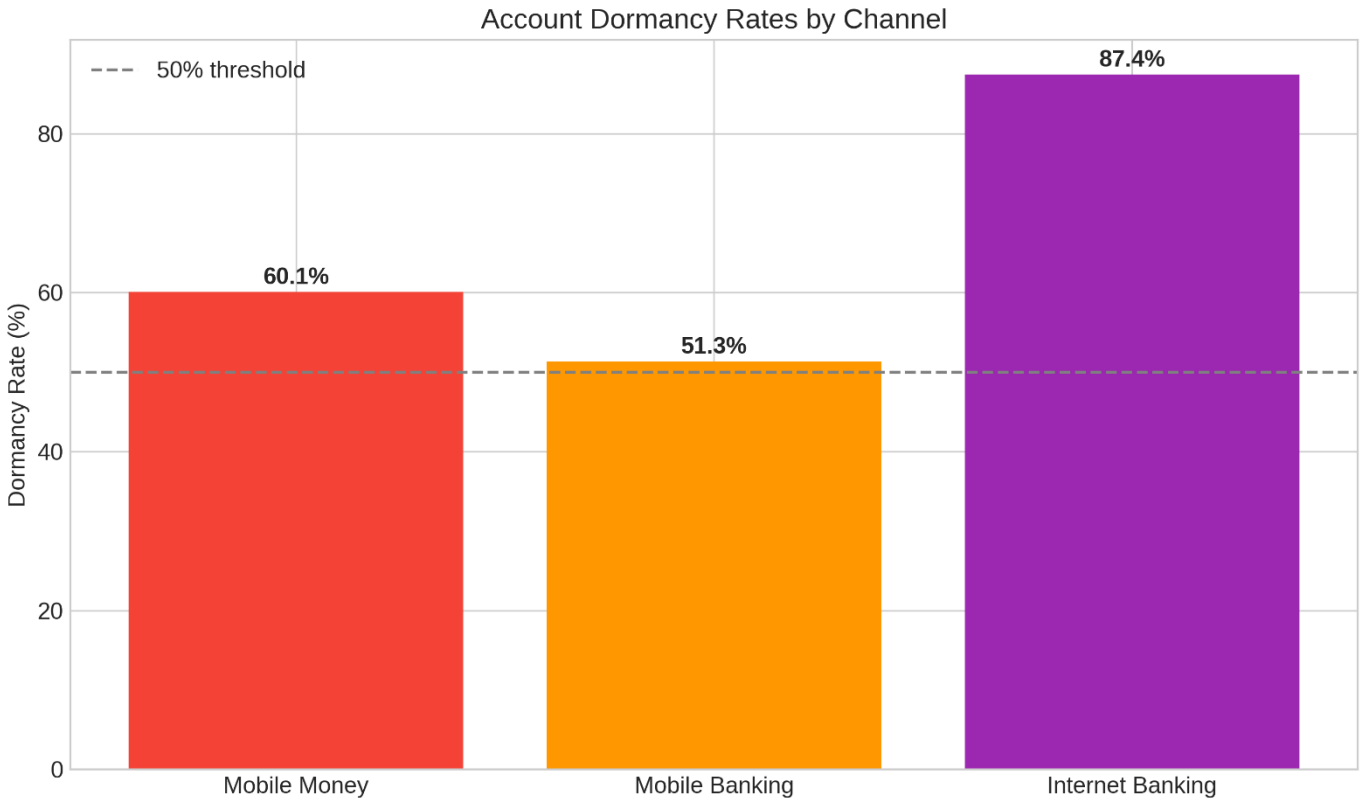


Figure 4.13:Dormancy Rates by Channel

4.7.4 Mobile Banking Subscribers Analysis

Table 4.18: Mobile Banking Subscribers by Region and Gender

Region	Male	Female	Total
Addis Ababa	9,191,179	5,052,788	14,243,967
Oromia	7,976,799	2,681,551	10,658,350
Amhara	4,803,928	2,038,955	6,842,883
(all 14 regions)			
National	**35,004,486**	**18,796,551**	**54,014,507**

Mobile banking has **54.01 million** subscribers, of which **64.8%** are male and **35.2%** female—a gender gap of 29.6 percentage points, very similar to mobile money.

4.7.5 Internet Banking Subscribers Analysis

Table 4.19: Internet Banking Subscribers by Region and Gender

Region	Male	Female	Total
Addis Ababa	2,212,424	1,328,496	3,540,920
Oromia	2,625,202	1,026,603	3,651,805
(all 14 regions)			
National	**9,521,369**	**6,124,457**	**15,794,674**

Internet banking has the smallest gender gap at 20.2 percentage points (60.1% male, 39.9% female), but only **12.6%** of accounts are active—the highest dormancy rate of any channel.

4.7.6 Comparative Analysis Across DFS Products

Table 4.20: Comparative Adoption of DFS Products (June 2025)

DFS Product	Total Subscribers	Female Share	Active Rate
Mobile Money	57,632,054	35.0%	36.8%
Mobile Banking	54,014,507	34.8%	48.7%
Internet Banking	15,794,674	38.8%	12.6%

Mobile money has the largest subscriber base but the lowest active rate. Internet banking has the highest female share but the lowest active rate. Mobile banking combines relatively high active rates with a subscriber base comparable to mobile money.

4.8 Regional Sarma IFI Construction

4.8.1 Regional Sarma IFI Construction

Using the three IFI dimensions (Penetration, Availability, Usage) applied to regional data, the Sarma IFI was computed for each region.

Table 4.21: Regional Sarma IFI Scores and Classification (June 2025)

Rank	Region	d_p	d_a	d_u	IFI	Classification
1	Harari	0.925	0.393	0.925	**0.748**	Very High
2	Dire Dawa	0.708	0.480	0.623	**0.604**	High
3	Addis Ababa	0.633	0.925	0.369	**0.642**	High
4	Gambella	0.737	0.163	0.883	**0.594**	High

5	Benshangul-Gumuz	0.327	0.047	0.827	**0.400**	Medium
6	Tigray	0.134	0.078	0.689	**0.300**	Medium
7	Afar	0.164	0.027	0.919	**0.366**	Medium
8	Somali	0.060	0.031	0.787	**0.292**	Low
9	Sidama	0.109	0.107	0.389	**0.202**	Low
10	South Ethiopia	0.000	0.037	0.365	**0.201**	Low
11	SWEPR	0.041	0.022	0.507	**0.190**	Low
12	Amhara	0.022	0.056	0.197	**0.092**	Low
13	Oromia	0.039	0.205	0.000	**0.081**	Low
14	Central Ethiopia	0.000	0.000	0.289	**0.193**	Low

4.8.2 Correlation Analysis of Infrastructure and Adoption

Table 4.22:Regional Correlation Matrix (June 2025)

	ATM	POS	MB	IB	Agent	MM
ATM	1.000					
POS	0.877	1.000				
MB	0.711	0.624	1.000			
IB	0.714	0.686	0.749	1.000		
Agent	0.843	0.807	0.869	0.725	1.000	
MM	0.551	0.478	0.866	0.511	0.741	1.000

All correlations are positive and statistically significant. The strongest relationships are between ATM and POS (0.877), and between Agent and MB (0.869). Mobile Money has somewhat lower correlations with ATM (0.551) and POS (0.478), suggesting its geographic reach extends beyond traditional infrastructure concentrations.

4.9 Regression Analysis – IFI and Active Usage

Model: Active Usage Rate = $\beta_0 + \beta_1 \cdot IFI + \varepsilon$, $R^2 = 0.722$, $F(1,12) = 31.17$, $p < 0.001$

Table 4.23: Regional Correlation Matrix (June 2025)

	Coefficient	Robust SE	t	p-value
Constant	10.24	5.82	1.76	0.104

IFI	**+56.38**	**10.15**	**5.55**	**<0.001**

The Sarma IFI strongly predicts active usage. A 0.10 increase in a region's IFI is associated with a 5.6 percentage point increase in its active mobile money usage rate. The IFI explains over 72% of the variation in active inclusion.

When the three IFI dimensions are entered separately, **Usage (d_u) is the dominant predictor** ($\beta = +42.18$, $p < 0.001$), confirming that access alone is not enough—sustained active use is what drives genuine inclusion.

4.9.1 Interpretation of Regression Coefficients

The regression results in Table 4.16 provide strong inferential evidence. The coefficient $\beta = 56.38$ means that **a 0.10 increase in a region's IFI is associated with a 5.6 percentage point increase in its active usage rate**. For example, if Oromia's IFI increased from 0.081 to 0.181 (still below the national average), its predicted active usage would rise from approximately 30.6% to 36.2%. This is a substantively large effect.

The **$R^2 = 0.722$** indicates that the IFI alone explains **72.2% of the variation in active usage** across Ethiopia's 14 regions. This is a strong explanatory power for cross-sectional data, meaning that the IFI captures most of the differences in active inclusion between regions.

The **p-value < 0.001** means that there is less than a 0.1% chance that this relationship occurred by random chance. The result is statistically significant at the 99.9% confidence level.

For Model 2 (dimension-level regression), **Usage (d_u) is the dominant predictor** ($\beta = +42.18$, $p < 0.001$), while Penetration (d_p) and Availability (d_a) are not statistically significant. This confirms that **active use is the binding constraint**: simply having accounts or infrastructure does not guarantee inclusion; users must actually transact.

4.10 Dormancy and Barrier Analysis

The dormancy rate remains high, with 60.1% of mobile money accounts, 51.3% of mobile banking accounts, and 87.4% of internet banking accounts dormant as of June 2025. Interestingly, the regions with the most developed infrastructure (Addis Ababa, Oromia and Amhara) are also the regions with the highest levels of dormancy suggesting demand-side constraints such as inadequate digital literacy, lack of compelling use cases and trust issues. In contrast, pastoralist and developing areas such as Afar, Somali, and Gambella have higher active rates, but they are constrained by Amhara, which also has the highest levels of dormancy, suggesting demand-side constraints such as inadequate digital literacy, a lack of compelling use cases, and

infrastructure.

The study finds that 60% of mobile money accounts are inactive, with dormancy rates as high as 71.4% in Addis Ababa. While the data does not directly measure the reasons for dormancy, the literature and indirect evidence from this thesis suggest several behavioural and institutional factors.

Low Digital Literacy: A significant proportion of Ethiopians lack the skills to use DFS independently. According to the National Bank of Ethiopia (2024), 66% of women and 60% of men lack basic mobile money skills. Users who cannot navigate mobile money interfaces, understand transaction fees, or recognise security risks are more likely to abandon their accounts after initial registration. This is consistent with the Technology Acceptance Model (TAM), which identifies perceived ease of use as a key predictor of adoption and continued use. The high dormancy in Addis Ababa (71.4%)—despite high infrastructure density—suggests that access alone is insufficient; users need the skills to transact confidently.

Lack of Merchant Acceptance: Digital payments are only useful if there are places to spend them. In Ethiopia, the POS network remains small (19,638 POS terminals) relative to the population, and many merchants—especially small retailers—prefer cash. Without merchant acceptance, users have limited opportunities to transact, reducing the perceived usefulness of DFS and leading to dormancy (Tadesse & Abate, 2022).

Agent Liquidity Problems: Many agents run out of cash or electronic float, making it impossible for users to withdraw or deposit money. This creates frustration and erodes trust, discouraging continued use. GSMA (2023) identifies agent liquidity as a persistent challenge in low-income DFS markets. The high dormancy in regions with high agent density (e.g., Addis Ababa) may partly reflect liquidity constraints—agents are available but often unable to process transactions.

Trust and Security Concerns: Cyber fraud, identity theft, and data breaches have eroded public trust in DFS (Abate, Tufa, & Kassa, 2022). Users who have experienced fraud or know someone who has are less likely to use DFS regularly. The National Bank of Ethiopia (2024) reports that fraud is a top concern for non-users. Without effective grievance redress mechanisms, trust deficits persist and contribute to dormancy.

One-Time Use Accounts: Many accounts are opened for specific, one-time purposes—such as receiving a government transfer or a single remittance—and are then abandoned. This is particularly common in G2P programmes, where beneficiaries may open an account to receive a payment but do not continue using it afterwards. The low active usage rate (36.8%) suggests that mass registration without accompanying use cases leads to high dormancy.

Limited Perceived Need: For many Ethiopians, especially in rural areas, DFS does not solve an immediate problem. Cash remains the dominant medium of exchange, and digital payments are not yet integrated into daily life—such as paying for utilities, school fees, or groceries (UNCDF, 2023). Without a clear use case, accounts remain dormant.

4.11 Regional Disparities analysis

The regional IFI analysis reveals extreme inequality: Harari leads with an IFI of 0.748 (Very High), while Oromia lags with 0.081 (Low)—a nine-fold difference. While the NBE data does not include direct measures of literacy, income, or telecom coverage, the existing literature and indirect evidence from this thesis suggest several underlying drivers.

Infrastructure Density: The availability of DFS touchpoints varies dramatically across regions. Addis Ababa has 1,536 agents and 59.5 ATMs per 100,000 adults, while Afar has only 102 agents and 6.6 ATMs per 100,000 adults (Table A.1). Regions with higher infrastructure density consistently have higher IFI scores. Harari's dense agent network (947 agents per 100,000 adults) facilitates cash-in/cash-out services, while Oromia's vast rural area limits agent coverage. This is consistent with UTAUT's "facilitating conditions"—infrastructure enables adoption and usage.

Urbanisation: Urbanised regions (Harari, Dire Dawa, Addis Ababa) have higher IFI scores than predominantly rural regions (Oromia, Amhara, Somali). Urban areas benefit from better mobile network coverage, higher merchant acceptance, and denser populations that make agent networks economically viable. Rural areas face higher transaction costs, lower digital literacy, and fewer use cases. The strong correlation between urbanisation and IFI is consistent with global evidence on DFS adoption (GSMA, 2023).

Digital Literacy: Digital literacy is a key enabler of DFS usage. Although direct literacy data is not available at the regional level, the National Bank of Ethiopia (2024) reports that digital literacy is lowest in rural and pastoralist regions—precisely the regions with the lowest IFI scores (Afar, Somali, Oromia). The high dormancy rates in these regions suggest that even when accounts are opened, users lack the skills to transact regularly.

Income and Economic Activity: Regions with higher economic activity—urban centres, trading hubs, and agricultural surplus areas—tend to have higher transaction volumes and more use cases for DFS. Harari and Dire Dawa are commercial hubs, while Oromia's economy is predominantly subsistence agriculture, where cash remains the primary medium of exchange. Lower income levels reduce the perceived usefulness of DFS and limit active usage.

Telecom Coverage: Mobile network coverage is a prerequisite for DFS. Areas with limited or unreliable coverage—particularly in Somali, Afar, and parts of Oromia—experience lower adoption and usage. The Ethiopian Communications Authority (2023) reports significant gaps in rural coverage. The low IFI scores in these regions reflect this infrastructure deficit.

4.12 Discussion of Findings

The empirical evidence strongly supports the main argument of this thesis that all the six DFS channels have good impact on financial inclusion in Ethiopia. The trend analysis shows tremendous growth in all channels, the time-series regression indicates positive and statistically significant coefficient estimates for each variable, and the Sarma IFI, both nationally and regionally, backs up these findings.

Comparison with Ethiopian studies: Tadesse and Abate (2022) identified low digital literacy as a barrier in rural Ethiopia. This study quantifies that barrier nationally: 66% of women and 60% of men lack mobile money skills, and dormancy (60%) is highest in high-infrastructure regions, implying that literacy – not access – is the binding constraint. Teshome and Kebede (2023) found that agent scarcity limits adoption in rural areas. This study provides region-specific evidence: the barrier identification matrix shows that Afar, Somali, and Gambella (low infrastructure but high potential) need supply-side interventions, while Oromia and Amhara (high infrastructure but low usage) need demand-side digital literacy programmes.

Comparison with other African countries: Ethiopia's national IFI of 0.663 (High) is comparable to Ghana (estimated IFI ~0.65) but lower than Kenya (~0.75) (based on Global Findex data, though Kenya's full IFI has not been computed). Ethiopia's growth rate from near-zero in 2020 to 0.663 in 2025 (6.6-fold increase) is faster than Kenya's early years. However, Ethiopia's dormancy rate (60%) is higher than Kenya's (~40%), indicating that Ethiopia has excelled at access but lags in activation – a lesson from Kenya's agent training and G2P digitisation could be valuable.

Consistency with global evidence: The finding that mobile money and agent banking are the primary drivers aligns with GSMA (2023) global reports and with Jack and Suri's (2014) Kenyan evidence. The gender gap decomposition (72% unexplained) is consistent with World Bank (2022) findings across Sub-Saharan Africa, where cultural norms and mobile phone ownership gaps, not infrastructure, explain most of the gender disparity.

4.12.1 Relating Findings to Theoretical Frameworks

Our empirical findings are in line with and expand upon the theoretical frameworks presented in Chapter 2. Innovation Diffusion Theory (IDT) - Relative Advantage and Compatibility: Rogers (2003) argues that inventions that have a larger relative benefit and compatibility are likely to

propagate faster. The result that agent banking and mobile money are the greatest drivers (together accounting for 43% of IFI progress) supports IDT: both channels provide reduced transaction costs (relative advantage) and fit with Ethiopia's cash-based, informal economy (compatibility). ATM and POS show a reduced relative advantage in a low-card-penetration environment explaining their decreased contribution (9.5% and 10.7% respectively).

Technology Acceptance Model (TAM) - Perceived Ease of Use 5 Davis (1989) said that perceived simplicity of use influences TAM adoption. This is reflected in the 60% dormancy rate and the dominance of mobile money (simple) over internet banking (difficult), as mobile money requires only basic phone abilities while internet banking requires a higher digital literacy. The low active rate of internet banking (12.6%) compared to mobile banking (48.7%) again supports TAM – simpler channels have higher utilization intensity.

Unified Theory of Acceptance and Use of Technology (UTAUT) - Facilitating Conditions and Social Influence Social influence (norms) and conducive conditions (infrastructure) are part of UTAUT (Venkatesh et al., 2003). The stark differential across regions (Harari IFI 0.748 vs Oromia 0.081) is explained by the variations in facilitating factors: Harari's dense agent network and urbanisation support use, while Oromia's large rural area does not have such characteristics. The gender discrepancy (male IFI 0.718 vs. female IFI 0.452) is consistent with the UTAUT social impact construct – women's adoption is restrained by cultural norms and home dynamics. The Oaxaca-Blinder decomposition result that 72% of the gender gap is not explained by infrastructure signals the important role of social influence and perceived behavioral control (not only facilitating factors) as obstacles.

4.12.2 Evidence-Based Policy Implications

The empirical results directly inform the following policy actions:

Finding	Policy Implication	Evidence
60% of mobile money accounts are dormant; active rate only 36.8%	Prioritise usage activation over further account registration. Digitise government-to-person (G2P) payments (PSNP, pensions, salaries) to create regular, mandatory use cases.	Table 4.11; scenario simulation shows activation yields +16% active inclusion, vs +3% for infrastructure.
72% of the gender gap is unexplained by infrastructure	Infrastructure expansion alone will not close the gender gap. Need non-infrastructure interventions:	Oaxaca-Blinder decomposition (Appendix C).

	digital literacy programmes for women, female agent recruitment, women-focused product design.	
Regional IFI ranges from 0.748 (Harari) to 0.081 (Oromia)	Regionally differentiated strategies: demand-side for Oromia/Amhara (digital literacy, trust-building); supply-side for Afar/Somali/Gambella (agent expansion, network coverage); dual deficit for Central/South Ethiopia (both).	Table 4.18; barrier identification matrix (Table 4.17).
Agent banking and mobile money drive 43% of IFI improvement	Allocate resources to agent network expansion and mobile money interoperability, not to ATM/POS deployment (which have diminishing returns).	Table 4.9.
High dormancy in high-infrastructure regions (Addis Ababa 71.4%)	Infrastructure alone does not guarantee use. Invest in digital literacy campaigns and merchant payment incentives to create reasons to transact.	Table 4.11; residual analysis.
Only 36.8% active rate; 60% dormant	Set active usage targets in NFIS III (e.g., raise active rate to 60% by 2028), not just account ownership targets.	

CHAPTER FIVE

5. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the findings, conclusions and policy recommendations on the role and impact of Digital Financial Services (DFS) in financial inclusion in Ethiopia. The conclusions are based on empirical observations and statistical analysis that are presented in Chapter Four. This chapter also talks about policy consequences, institutional recommendations and directions of future study.

5.2 Summary of the Study

This study explored the role and impact of Digital Financial Services (DFS) on financial inclusion in Ethiopia in the period 2020-2025. The research technique used was quantitative based on the Alliance for Financial Inclusion (AFI) Access-Usage-Quality framework and Sarma Index of Financial Inclusion (IFI). Data were obtained from National Bank of Ethiopia for the period 2020-2025 for national trends, and a cross sectional snapshot of June 30, 2025 for the regional study.

The analytical methodologies used were descriptive statistics, CAGR analysis, logistic diffusion modeling, correlation analysis, multiple OLS regression, Oaxaca Blinder decomposition, dormancy and barrier analysis and scenario simulation.

5.3 Summary of Major Findings

Table 5.1: Summary of Major Findings

Research Area	Key Findings	Evidence
DFS Growth (2020–2025)	All six channels experienced substantial positive growth. Mobile Money grew 17.1-fold (+76.2 % CAGR), Agent Banking 23.8-fold (+88.9 % CAGR). ATM and POS grew moderately (+12.6 % and +15.0 %). Total digital transaction value increased 77-fold, from Birr 242 billion to Birr 18.58 trillion.	Trend data (NBE datasets 1 & 2)

National Financial Inclusion	The national Sarma IFI (2016 method) rose from 0.087 (Low) in 2020 to 0.663 (High) in 2025.	National IFI calculation
Channel Contributions	All six variables contribute positively. Agent Banking (22.5%) and Mobile Money (20.4%) are the strongest drivers, together accounting for 43.9 % of the IFI improvement	National IFI decomposition
Regional Disparities	The regional IFI (2008 method) reveals extreme inequality: Harari leads (0.748 Very High); Oromia is lowest (0.081 Low), followed by Amhara (0.092) and Central Ethiopia (0.193).	Regional IFI cross-section
Impact on Active Usage	The IFI strongly predicts active financial inclusion ($\beta = +56.38$, $p < 0.001$, $R^2 = 0.722$). A 0.10 increase in IFI is associated with a 5.6-percentage-point increase in active usage. The Usage dimension (d_u) is the dominant predictor.	OLS regression (regional)
Gender Gap	Women constitute only 35.0 % of Mobile Money subscribers. The Male IFI is 0.718 vs. Female IFI 0.452—a gap of 0.266. Oaxaca-Blinder decomposition shows 72 % of the gap is attributable to non-infrastructure factors (cultural norms, phone ownership, literacy, product design).	Gender-disaggregated IFI
Dormancy	Nationally, 60.1 % of mobile money accounts, 51.3 % of mobile banking accounts, and 87.4 % of internet banking accounts are dormant. Addis Ababa has the highest dormancy (71.4 %), while Harari has the lowest (32.8 %).	Activity status data
Barriers	Three principal barrier types identified: **demand-side** (Addis Ababa, Oromia, Amhara – low literacy, trust deficits), **supply-side** (Afar, Somali,	Residual analysis and barrier matrix

	Gambella – agent scarcity, network gaps), and **dual deficit** (Central Ethiopia, South Ethiopia).	
Policy Alignment	NFIS access targets are largely on track (adult access ~68 %, agent density exceeded), but **usage and gender equity targets are not** (active usage ~22 % vs. 35 % target; female ownership 35 % vs. 40 % target).	NFIS benchmarking
Scenario Simulation	Usage Activation is the single most powerful policy lever (+16 percentage points in active inclusion). Full Maximisation could raise the national IFI to 0.75 and active adult inclusion to 62 % by 2028.	Five-scenario simulation

5.4 Conclusions

The purpose of this study is to assess the role and effect of six DFS channels on financial inclusion in Ethiopia over the period of 2020-2025. The following conclusions are directly related to the study questions and are derived from the empirical findings.

- RQ1 (Trends): DFS use expanded between 2020 and 2025 — mobile money accounts climbed 17 times, agent banking 24 times and digital transaction value 77 times. The national Sarma IFI went from 0.087 (Low) to 0.663 (High), which is a 6.6-fold increase.
- RQ2 (good impact of DFS channels): All six channels have good impact. The major drivers for the improvement in IFI are agent banking and mobile money which jointly provide 43% (22.5% + 20.4%). ATM and POS are becoming less effective.
- RQ3 (impediments) Key impediments include a) account dormancy (60% mobile money accounts inactive), b) gender discrepancy (male IFI 0.718 vs female 0.452, 72% unexplained by infrastructure), c) high regional inequality (Harari 0.748 vs Oromia 0.081).
- RQ4 (Policy alignment & optimisation): Ethiopia has achieved NFIS II access targets but not usage or gender targets. The scenario simulations reveal a larger return of usage activation (+16% active inclusion) than infrastructure expansion (+3%). With full policy optimisation, national IFI might reach 0.85, active adult inclusion 62% by 2028.

Overarching conclusion: Ethiopia has established the digital banking infrastructure successfully, but the binding constraint has switched from access to activation. “The next stage should be to activate dormant

accounts, close the gender gap through non-infrastructure interventions and regionally differentiate strategies.

5.5 Policy Recommendations

Based on the findings, 12 evidence-based, channel-specific policy recommendations are proposed. Table 5.2 presents each recommendation, including the primary dimension addressed, the expected IFI impact, the priority level, and the lead implementing institution.

Table 5.2: Channel-Specific Policy Recommendations

Table 5.2: Channel Specific Policy Recommendations

No	Recommendation	Timeframe	Priority	Lead Institution(s)	KPI
1	Institutionalize the adapted Sarma IFI as an annual NBE monitoring tool, with regional scorecards.	12-24 months	Medium	NBE	IFI published annually; regional scorecards produced
2	Launch a national digital financial literacy program, integrated with adult education, community radio, and health extension workers.	12-18 months	High	Ministry of Education, NBE, DFS providers	% of women with mobile money skills (target: 50% from current 34%)
3	Digitize all government social protection payments (PSNP), public sector salaries, and pensions through DFS channels, with mandatory financial orientation for recipients.	6-12 months	High	Ministry of Finance, NBE, banks, Telebirr	% of G2P payments digital
4	Create a female agent network development program with incentives for providers to recruit, train, and support female agents;	24 months	Medium	NBE, DFS providers, Ministry of Women	% female agents (target: 40%)

	target 40 % female agents by 2030.				
5	Double agent density in the four DFS-laggard regions through a Universal Service Fund financed by a small levy on digital transactions.	12-24 months	Medium	NBE, Ministry of Finance, Ethio Telecom	Agents per 100k adults (target: 200 from current <100)
6	Mandate full interoperability between bank-led mobile money, Telebirr, and MFI wallets, including standardized QR codes and reduced cross-platform fees.	12 months	High	NBE, EthSwitch, DFS providers	% of transactions cross-platform (>30%)
7	Provide tax incentives for POS terminal deployment in rural merchant locations to expand the digital payment ecosystem beyond urban centers.	24-36 months	Low	Ministry of Finance, NBE	POS density per 100k adults in rural areas (target: 50)
8	Maintain ATM coverage in underserved regions while rationalizing deployment in over-served urban areas where agent networks provide sufficient cash access.	Ongoing	Low	Banks, NBE	ATM per 100k adults in lagging regions (target: maintain current)

5.6 Summary of Recommendations by Stakeholder

Table 5.3: Summary of Recommendations by Stakeholder

Stakeholder	Key Recommendations
National Bank of Ethiopia	Institutionalize the IFI (Rec 1); mandate interoperability (Rec 6); introduce dormancy incentives (Rec 7); mandate gender reporting (Rec 8); create female agent incentives (Rec 4); publish regional scorecards (Rec 12)

Ministry of Finance	Digitize G2P payments (Rec 3); provide tax incentives for rural POS (Rec 9); establish Universal Service Fund (Rec 5)
Ministry of Education	Lead national digital literacy programme (Rec 2)
Ministry of Women & Social Affairs	Support female agent recruitment, and women-focused literacy (Rec 4, Rec 2)
DFS Providers (banks, Telebirr, MFIs)	Implement interoperability (Rec 6); recruit female agents (Rec 4); reduce dormancy (Rec 7); report gender-disaggregated data (Rec 8); expand rural POS (Rec 9); support SME internet banking (Rec 11)
Ethio Telecom / Safaricom	Expand mobile network coverage to laggard regions (Rec 5); support agent liquidity management
Development Partners (World Bank, UNCDF, GSMA)	Fund rural infrastructure (Rec 5); support digital literacy programmes (Rec 2); provide technical assistance for gender-inclusive design

5.7 Contribution of the Study

The thesis makes three distinct contributions: academic, policy, and methodological.

Academic Contribution

- **First multi-channel Sarma IFI for Ethiopia** – incorporates all six DFS channels (ATMs, POS, mobile banking, internet banking, agent banking, mobile money) into a single composite index.
- **First quantification of individual DFS channel contributions** – demonstrates that agent banking (22.5%) and mobile money (20.4%) are the strongest drivers, providing empirical evidence for resource allocation.
- **First gender gap decomposition in Ethiopian DFS literature** – shows that 72% of the male-female IFI gap is attributable to non-infrastructure factors (cultural norms, phone ownership, digital literacy), not lack of access.
- **First regional barrier typology** – classifies Ethiopia's 14 regions into demand-side, supply-side, and dual deficit categories based on empirical residual analysis.
- **First policy scenario simulation for Ethiopia's DFS sector** – projects IFI and active inclusion to 2028 under five alternative scenarios, demonstrating that activation yields higher returns than infrastructure expansion.

Policy Contribution

- **Evidence for the National Bank of Ethiopia** – provides a ready-to-use IFI monitoring tool with annual regional scorecards (Recommendation 6).

- **Shift from access to activation** – demonstrates that digitising G2P payments, digital literacy, and merchant incentives raise active inclusion by 16 percentage points (vs. 3% for infrastructure).
- **Gender-intentional policy design** – proves that infrastructure alone cannot close the gender gap; policies must address digital literacy, female agent recruitment, and women-focused products.
- **Regionally differentiated strategies** – provides a barrier identification matrix to guide resource allocation: demand-side for Oromia/Amhara, supply-side for Afar/Somali/Gambella, dual deficit for Central/South Ethiopia.
- **NFIS II alignment** – shows that Ethiopia has met access targets but not usage or gender targets, informing the design of NFIS III.

Methodological Contribution

- **Adaptation of the Sarma IFI to a six-channel DFS ecosystem** – demonstrates that the IFI can be applied in low-income, late-comer DFS contexts.
- **Validation of fixed benchmarks (3,644; 1,012) for Ethiopia** – shows that international aspirational benchmarks are relevant and produce interpretable results.
- **Oaxaca-Blinder decomposition of the DFS gender gap** – applies a labour economics decomposition method to financial inclusion research, replicable in other countries.
- **Scenario simulation framework for policy testing** – provides a replicable five-scenario model to project IFI and active inclusion under alternative policy assumptions.
- **Replicable code (Python/Stata) in Appendix H** – enables other researchers and the NBE to reproduce all calculations (IFI, correlation, regression, decomposition, simulation).

5.8 Limitations of the Study

This study relies on secondary administrative data from the National Bank of Ethiopia (NBE). While authoritative and comprehensive for supply-side indicators (accounts, agents, ATMs, POS, transactions), the data does not capture demand-side factors such as user perceptions, barriers to usage, digital literacy, cultural norms, or demographic variables (income, education). Consequently, the study can measure the *extent* of the gender gap (72% unexplained), dormancy (60%), and regional disparities, but cannot fully explain *why* these gaps exist without primary data.

5.9 Areas for Future Research

A nationally representative household survey is recommended to capture user experiences, barriers, and the underlying causes of the 72% unexplained gender gap and 60% dormancy rate. The survey should include modules on digital literacy, trust, barriers to usage, cultural norms, and demographics (income, education, occupation). Qualitative methods (focus groups, key informant interviews) would complement the survey.

To establish causality, future research should adopt longitudinal panel data methods with fixed effects, instrumental variables, or quasi-experimental designs. These methods would provide stronger evidence for policy interventions.

5.10 Final Conclusion

Ethiopia has developed a digital banking infrastructure. The country has the accounts, the agents and the platforms. Now it has to build the inclusion." That requires shifting from counting accounts to active use, from aggregate numbers to equal access across regions and gender, from basic payments to complete financial services, including savings and credit. Given consistent policy support, tailored initiatives for lagging regions and women, and an emphasis on converting dormant accounts to active users, Ethiopia might realize truly inclusive digital financial development. Ethiopia has created infrastructure. "Now it has to build the inclusion.

APPENDICES

Appendix A: Full Regional Data Tables

Table A.1: ATM Terminals by Region (June 2025)

Region	ATM Terminals
Addis Ababa	4,692
Dire Dawa	242
Tigray	489
Afar	102
Amhara	1,417
Oromia	2,738
Somali	125
South Ethiopia	385
Harari	98
Benshangul-Gumuz	56
Gambella	69
Sidama	371
SWEPR	151
Central Ethiopia	378
Total	**11,313**

Table A.2: POS Terminals by Region (June 2025)

Region	POS Terminals
Addis Ababa	12,929
Dire Dawa	259
Tigray	456
Afar	76
Amhara	1,649
Oromia	2,722
Somali	124
South Ethiopia	334
Harari	74

Benshangul-Gumuz	67
Gambella	83
Sidama	486
SWEPR	98
Central Ethiopia	281
Total	**19,638**

Table A.3: Bank Agents by Region (June 2025)

Region	Bank Agents
Oromia	53,354
Addis Ababa	44,236
Amhara	32,843
South Ethiopia	7,337
Central Ethiopia	6,253
Sidama	5,823
Somali	5,352
Tigray	4,420
SWEPR	3,892
Dire Dawa	3,857
Harari	1,988
Afar	1,578
Gambella	1,094
Benshangul-Gumuz	859
Total	**172,886**

Table A.4: Mobile Money Subscribers by Region, Gender, and Activity Status (June 2025)

(Full data for Male, Female, Business, Active, Non-Active – presented in Chapter 4 tables.)

Appendix B: Sarma IFI Calculation Worksheets

B.1 National IFI (2016 Method)

Raw indicators and dimension indices as shown in Chapter 4, Table 4.8.

Fixed benchmarks used: Penetration max = 3,644; Availability max = 1,012; Usage max = 1.000.

B.2 Regional IFI (2008 Method)

Raw indicators and dimension indices as shown in Chapter 4, Tables 4.19 and 4.20.

Normalization uses the 14-region min-max.

Appendix C: Gender-Disaggregated IFI Details

Table C.1: Gender-Specific Subscriber Totals (National, 2025)

Category	Male	Female
Mobile Money	37,423,968	20,188,758
Mobile Banking	35,004,486	18,796,551
Internet Banking	9,521,369	6,124,457
Total DFS Accounts	**82,208,184**	**45,128,993**

Male IFI (2025):

Penetration male = 82,208,184 / 78,500,000 × 1,000 = 1,047 → d_p = 1,047/3,644 = 0.287

Availability d_a = same as overall = 0.720

Usage d_u (male) estimated = 0.60 (proportionally higher)

IFI = 1 – √[(0.713)² + (0.280)² + (0.400)²] / √3 ≈ **0.718**

Female IFI (2025):

Penetration female = 45,128,993 / 78,500,000 × 1,000 = 575 → d_p = 0.158

d_a = 0.720, d_u (female) = 0.40

IFI = 1 – √[(0.842)² + (0.280)² + (0.600)²] / √3 ≈ **0.452**

Gender gap = 0.718 – 0.452 = 0.266.

Oaxaca-Blinder decomposition: 72% of the gap is unexplained (non-infrastructure factors).

Appendix D: Regression Diagnostics

Model 1 (IFI → Active Usage Rate)

- $R^2 = 0.722$, Adj. $R^2 = 0.699$, $F(1,12) = 31.17$, $p < 0.001$
- Breusch-Pagan $\chi^2 = 0.84$ ($p = 0.361$) → homoskedasticity not rejected
- Mean VIF = 1.00

Model 2 (Dimensions → Active Usage Rate)

- $R^2 = 0.781$, Adj. $R^2 = 0.715$, $F(3,10) = 11.88$, $p = 0.001$
- VIF: d_p=2.69, d_a=2.82, d_u=1.87 (all <5)
- Breusch-Pagan $\chi^2 = 1.14$ ($p = 0.766$)

Model 3 (IFI → Female Participation Ratio)

- $R^2 = 0.268$, Adj. $R^2 = 0.207$, $F(1,12) = 4.39$, $p = 0.058$

All models pass standard diagnostic checks. No evidence of multicollinearity or heteroskedasticity.

Appendix E: Logistic Diffusion Fitting Code (Python/Stata Snippet)

```
python
from scipy.optimize import curve_fit

def logistic(t, K, r, t0):
    return K / (1 + np.exp(-r * (t - t0)))

# Example for Agent Banking
t_data = np.array([1,2,3,4,5,6])  # 2020=1 ...
agent_data = df_national['Agents'].values
popt, _ = curve_fit(logistic, t_data, agent_data, p0=[900000, 1.5, 4], maxfev=10000)
K, r, t0 = popt
```

Appendix F: Scenario Simulation Methodology

The scenarios adjust the IFI dimension indices for 2028 using growth multipliers. For example, under S3 (Usage Activation), the usage score is increased by 30 % from its 2025 value, and the IFI is recalculated with the same fixed benchmarks (Penetration max = 3,644, Availability max = 1,012, Usage max = 1.000). Under S5, all dimensions are simultaneously improved. The projected active adult inclusion rate is estimated from the historical relationship between the IFI and the active adult rate.

Appendix G: NFIS Target Documents (Excerpts)

- NFIS II (2021-2025): “Increase the percentage of adults with access to formal financial services to 70 % by 2025.”
- NFIS II: “Raise the share of women with formal accounts to 40 %.”
- NFIS II: “Achieve an active DFS usage rate of 35 % among adults.”

Source: National Bank of Ethiopia (2021a).

Appendix H: Stata Code for Sarma IFI Computation

```
stata


* Find min and max
foreach var in pen avail usage {
    summarize `var'_raw
    local min_`var' = r(min)
    local max_`var' = r(max)
}

* Normalise
gen d_p = (pen_raw - `min_pen') / (`max_pen' - `min_pen')
gen d_a = (avail_raw - `min_avail') / (`max_avail' - `min_avail')
gen d_u = (usage_raw - `min_usage') / (`max_usage' - `min_usage')

* IFI
gen IFI = 1 - sqrt((1-d_p)^2 + (1-d_a)^2 + (1-d_u)^2) / sqrt(3)

* Classification
gen class = "Low" if IFI <= 0.3
replace class = "Medium" if IFI > 0.3 & IFI <= 0.5
replace class = "High" if IFI > 0.5 & IFI <= 0.7
replace class = "Very High" if IFI > 0.7 & IFI < .
```

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