FINTECH ADOPTION AND RISK MANAGEMENT: THE MEDIATING ROLE OF REGULATORY ENVIRONMENT, TECHNOLOGICAL INFRASTRUCTURE, AND ORGANIZATIONAL READINESS: EVIDENCE FROM DASHEN BANK

BY: HABTAMU DATTA

ADVISOR: HABTAMU ENDRIS (PhD)

ID: GSE/9708/15

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN BUSINESS ADMINISTRATION

MAY 2025,

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DECLARATION

I, the undersigned, declare that this thesis entitled "FinTech Adoption and Risk Management: The Mediating Role of Regulatory Environment, Technological Infrastructure, and Organizational Readiness: Evidence from Dashen Bank" is my original work, prepared under the guidance of my advisor Habtamu Endris (PhD). It has not been submitted previously, in whole or in part, for any degree or diploma at any university or institution of higher learning. All sources of materials used for the thesis from the published or unpublished works of others have been duly acknowledged and referenced.

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Name **Signature**

Addis Ababa University, Addis Ababa **May 2025**

ENDORSEMENT

This thesis has been submitted to Addis Ababa University, School of Graduate Studies for examination with my approval as a university advisor.

Habtamu Endris (PhD)

Advisor **Signature**

Addis Ababa University, Addis Ababa **May 2025**

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

Acronym	Definition
AI	Artificial Intelligence
AML	Anti-Money Laundering
AML/CFT	Anti-Money Laundering/Combating the Financing of Terrorism
API	Application Programming Interface
ATM	Automated Teller Machine
CBDC	Central Bank Digital Currency
CSP	Cloud Service Provider
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
IoT	Internet of Things
KYC	Know Your Customer
ML	Machine Learning
MFI	Microfinance Institution
NBE	National Bank of Ethiopia
P2P	Peer-to-Peer
PPP	Public-Private Partnership
R&D	Research and Development
SEM	Structural Equation Modeling
SME	Small and Medium Enterprises
TAM	Technology Acceptance Model
UI	User Interface
UX	User Experience
VaR	Value-at-Risk

ABSTRACT

In the evolving digital landscape, Financial Technology (FinTech) has emerged as a transformative force within the banking sector, particularly in enhancing risk management frameworks. This study investigates the relationship between FinTech adoption and risk management practices in Ethiopian commercial banks, using Dashen Bank as a case study. The research examines how regulatory environment, technological infrastructure, and organizational readiness mediate the impact of FinTech tools such as AI, machine learning, blockchain, and big data analytics on risk identification, assessment, and mitigation. A mixed-methods approach was employed, combining quantitative survey data and qualitative interviews. Structural Equation Modeling (SEM) was used to analyze the mediating role of institutional factors in FinTech adoption. The results indicate that while FinTech significantly improves the efficiency and responsiveness of risk management processes, its integration is highly contingent upon supportive regulatory frameworks, technological capability, and organizational preparedness. Findings also highlight that regulatory ambiguity, infrastructural deficits, and skill shortages constrain full-scale adoption. This study contributes to academic discourse by filling a research gap in developing economies regarding FinTech's operational impact on banking risk management. It offers practical insights for bank managers, policy makers, and technology developers, advocating for improved collaboration between financial institutions and regulators. Recommendations include regulatory reforms, investment in digital infrastructure, capacity building, and promoting a conducive ecosystem for FinTech-driven innovation in risk management.

Keywords: FinTech, Risk Management, Regulatory Environment, Technological Infrastructure, Organizational Readiness, Structural Equation Modeling, Ethiopia, Dashen Bank

CHAPTER ONE

INTRODUCTION

This chapter provides the foundational framework for the study, beginning with an introduction to the background that contextualizes the emergence and increasing relevance of Financial Technology (FinTech) within both the global and Ethiopian banking sectors. It then outlines the problem that drives the research, followed by clearly defined research objectives and questions that will guide the investigation. Furthermore, the chapter discusses the significance of the study for academic, practical, and policy-making audiences, and establishes the scope and limitations to define the parameters of the research. Finally, the chapter concludes with a brief overview of the thesis structure, setting the stage for the subsequent chapters. Overall, this chapter serves as a crucial starting point for understanding the importance and focus of the study on FinTech in the banking sectors, both globally and within Ethiopia.

1.1. Background of the Study

In the digital era, the financial services sector has been transformed by the rapid advancement of Financial Technology (FinTech), which combines software, data analytics, and digital platforms to enhance the efficiency, security, and accessibility of financial services (Gomber, Koch, & Siering, 2017). This transformation is not limited to consumer-facing innovations but has extended to core banking operations especially risk management, which is a critical function in ensuring institutional stability, regulatory compliance, and operational resilience.

The ability of FinTech tools to process large volumes of structured and unstructured data in real-time has enabled banks to shift from reactive to proactive risk management models. FinTech applications, including machine learning, big data analytics, blockchain, and artificial intelligence (AI), allow for predictive modeling, fraud detection, and anomaly tracking (Gai, Qiu, & Sun, 2018; Bussmann, 2017). These capabilities enhance credit risk scoring, automate compliance reporting, and monitor suspicious transactions in real time, leading to improved oversight and risk mitigation strategies (Aebi, Sabato, & Schmid, 2012).

However, the effectiveness of FinTech in improving risk management does not occur in a vacuum. The relationship is mediated by the level of FinTech adoption, which is itself influenced by various institutional factors. This is where the "how" and "why" of this study take shape. FinTech does not directly transform risk practices unless adopted and embedded within the bank's internal systems. The mediating role of adoption is key organizational readiness, technological infrastructure, and regulatory frameworks shape how, when, and to what extent FinTech tools are integrated into banking processes (Arner, Barberis, & Buckley, 2016; Menon, 2016).

According to the Technology Acceptance Model (TAM) and Institutional Theory, the perceived usefulness and institutional alignment of a technology are critical to its successful adoption (Scott, 2005). Banks may be aware of the potential benefits of FinTech tools, but without regulatory clarity, technical infrastructure, and managerial support, these tools remain underutilized. This adoption gap weakens the expected benefits of FinTech on risk management outcomes.

In developing economies like Ethiopia, this mediation effect is especially relevant. Despite growing FinTech ecosystems and digital financial services, many banks face institutional barriers that obstruct full integration into risk management frameworks. These barriers include outdated IT infrastructure, limited access to skilled personnel, and ambiguous or restrictive regulatory environments (Kinfack, 2020; National Bank of Ethiopia, 2020). As a result, while the potential of FinTech is acknowledged, its actual impact on operational risk, compliance risk, and credit risk management remains uneven and underexplored.

In Ethiopia, the financial sector is undergoing transformation, with institutions like Dashen Bank investing in digital platforms and mobile services. However, the institutional environment including the role of the National Bank of Ethiopia plays a decisive role in whether these technologies are adopted effectively or stagnate. The mediating effect of FinTech adoption, therefore, becomes a pivotal analytical lens in understanding the true contribution of technology to risk management in emerging markets.

Moreover, existing studies emphasize the need to unpack not just whether FinTech improves risk management, but under what conditions, through which institutional levers, and to what extent (Chen et al., 2019; Jobst, 2014). The research seeks to explore this mediated relationship using empirical data from Dashen Bank, testing whether institutional factors regulatory support, technological readiness, and organizational support act as enablers or bottlenecks to FinTech adoption, and whether this adoption subsequently leads to better risk outcomes.

In summary, the integration of FinTech into risk management systems has the potential to transform banks' approaches to identifying and mitigating risks. However, this transformation is contingent upon adoption, which is shaped by internal and external institutional factors. Thus, this study seeks to illuminate the mediated link between institutional readiness and risk management effectiveness, with FinTech adoption as the critical bridge between potential and practice in Ethiopia's banking sector.

1.2. Statement of the Problem

Banking plays a vital role in sustaining and developing economic growth, which makes effective risk management a top priority. The advent of financial technology (FinTech) has fundamentally altered traditional risk management practices worldwide, introducing new and unique challenges (Chen et al., 2019). By enabling banks to harness advanced data analytics, artificial intelligence (AI), machine learning, and blockchain, FinTech offers enhanced capabilities to detect, quantify, and control risks. In advanced economies, such innovations have significantly improved the detection of fraud, prediction of credit risk, assurance of regulatory compliance, and streamlining of operational risk management (Gomber, Koch, & Siering, 2017; Bussmann, 2017).

However, in developing economies such as Ethiopia, the diffusion and integration of FinTech into risk management practices remain limited. While the Ethiopian banking sector has made notable progress in digital banking particularly through platforms like mobile and internet banking the adoption of advanced FinTech tools for risk management is not yet widespread (Akinboade & Kinfack, 2020). Traditional risk frameworks in Ethiopian banks continue to rely heavily on retrospective models, manual processes, and rigid regulatory compliance, making them less responsive to emerging risks in a digital environment (Basel Committee on Banking Supervision, 2019; Ravi, 2016).

Although there is growing recognition of FinTech’s potential to modernize risk management, Ethiopian banks face institutional challenges that impede its integration. These include limited access to technical infrastructure, skill shortages in advanced analytics, and restrictive or ambiguous regulatory policies (National Bank of Ethiopia, 2020). For instance, while AI-driven tools can significantly enhance fraud detection, their implementation requires a skilled workforce, robust data environments, and supportive legal frameworks all of which are currently underdeveloped in Ethiopia (Chen et al., 2019; Arner, Barberis, & Buckley, 2016).

The regulatory environment also poses a substantial constraint. Ethiopia’s central bank, the National Bank of Ethiopia (NBE), has historically adopted a conservative regulatory stance, prioritizing financial stability over innovation. Although such caution has preserved systemic integrity, it has also delayed the introduction of regulatory frameworks conducive to FinTech innovation (Kinfack, 2020). This creates a misalignment between technological potential and institutional readiness, particularly in the areas of compliance automation, cybersecurity, and real-time monitoring.

In this context, Dashen Bank one of Ethiopia’s leading financial institutions provides a compelling case study. Despite its early adoption of digital financial services, the bank has yet to fully implement advanced FinTech solutions in its risk management framework. The adoption gap highlights deeper issues of organizational readiness, regulatory ambiguity, and infrastructural limitations that constrain the bank’s ability to optimize risk practices through technology (Dashen Bank, 2021).

Moreover, there is a clear empirical and conceptual gap in current research. While global studies have examined FinTech’s contribution to financial inclusion and operational efficiency, few have systematically investigated its role in risk management within the unique institutional settings of emerging markets like Ethiopia (Jack, 2016; Gomber et al., 2017). Most existing frameworks are developed from high-income contexts and do not account for the mediating effects of regulatory, technological, and organizational readiness specific to developing economies.

This study seeks to fill that gap by examining how institutional factors influence FinTech adoption and, in turn, how such adoption affects risk management practices at Dashen Bank. In doing so, the research addresses not just whether FinTech can improve risk management, but under what conditions and through which enabling mechanisms it can do so effectively. By contextualizing global insights within the Ethiopian banking landscape and comparing experiences with other African markets such as Kenya and Nigeria, this study aims to generate locally relevant recommendations for advancing risk management through FinTech.

1.3. Research Questions

Based on the identified research problems, this study will be conducted to answer the following research questions:

1. To what extent does FinTech adoption enhance the effectiveness of risk management practices particularly in credit, compliance, and operational risk within Dashen Bank?
2. What institutional factors (regulatory environment, technological infrastructure, and organizational readiness) significantly influence the adoption and integration of FinTech in Dashen Bank's risk management framework?
3. What are the main barriers (technical, regulatory, and organizational) impeding FinTech-driven risk management implementation at Dashen Bank?
4. How can Dashen Bank strategically overcome these institutional and operational barriers to fully leverage FinTech for effective risk management?

1.4. Objectives of the Study

1.4.1. General Research Objective

The General objective of the proposed study is to examine how the adoption of FinTech technologies impacts the effectiveness of risk management practices at Dashen Bank, considering the mediating roles of regulatory environment, technological infrastructure, and organizational readiness.

1.4.2. Specific Research Objectives

To achieve the above general objective there will be specific objectives that need to be accomplished. The specific objectives are the following:

This study will be conducted to address the following research objectives:

- To evaluate the level and types of FinTech adoption in risk identification, assessment, mitigation, and monitoring within Dashen Bank.
- To analyze how institutional enablers specifically regulatory clarity, infrastructure capability, and organizational readiness mediate FinTech adoption.
- To assess the specific impact of FinTech on managing credit, operational, and compliance risks.
- To identify practical challenges faced by Dashen Bank in implementing FinTech-enabled risk management.
- To propose targeted, evidence-based strategies for enhancing FinTech adoption in risk management at Dashen Bank.

1.5. Hypothesis

This study assumes that implementing financial technology (FinTech) would have a positive effect on risk management approaches in Ethiopian commercial banks, with Dashen Bank as an exemplar case. Specifically, the following hypotheses are proposed:

H1: The adoption of FinTech considerably enhances the efficiency of risk identification, risk assessment and risk mitigation in the risk management practices of Dashen Bank.

H2: Institutional factors (regulatory, technological and organizational) play a substantial role in baseline FinTech adoption in risk management within Dashen Bank.

H3: Adoption of FinTech is more effective in mitigating certain risk types (credit risk, compliance risk, operational risk), as compared to using traditional forms of risk management, at Dashen Bank.

H4: Comparison experiences across other emerging markets (e.g., Kenya, Nigeria) offer practical recommendations for improving FinTech adoption within Dashen Bank's risk management context.

1.6. Scope of the Study

This study examines the integration of FinTech in risk management at Dashen Bank, focusing on technological advances such as mobile banking, artificial intelligence (AI), machine learning, blockchain, and big data analytics. It assesses the regulatory, infrastructural, and organizational factors influencing adoption within Ethiopian commercial banks.

The research is limited to Dashen Bank, with findings potentially applicable to similar institutions in Ethiopia. While incorporating global insights, the study remains contextually focused on Ethiopia’s banking sector. It covers FinTech developments over the past five years, using surveys, interviews, and secondary data sources.

By defining these boundaries, the study aims to provide practical recommendations for enhancing FinTech driven risk management in Ethiopian banks.

1.7. Significance of the Study

This study on the adoption of financial technology (FinTech) for risk management in Ethiopian banks aims to provide significant contributions to academic literature, practical applications within the banking sector, and policymaking in emerging economies. Academically, it contributes to the limited literature on FinTech adoption in developing countries by providing empirical evidence on its effect on risk management, a field extensively studied in developed economies but underexplored in contexts like Ethiopia (Gomber, Koch, & Siering, 2017; Jack, 2016). By presenting a contextualized analysis through a case study of Dashen Bank, the research offers insights into the suitability of advanced risk management tools in low- and middle-income settings.

Practically, the study provides Ethiopian banks with guidance on integrating FinTech solutions into their risk management systems. It examines the impact of technologies such as AI, machine learning, and blockchain on functions like risk identification, assessment, mitigation, and monitoring, thereby informing investment in technology infrastructure, staff training, and strategic planning. Additionally, the findings have policy implications for regulators, particularly the National Bank of Ethiopia, by suggesting frameworks that foster innovation while ensuring financial stability. Finally, the study offers valuable information for technology developers by identifying the specific challenges and needs of Ethiopian banks, thus promoting the development of scalable and cost-effective FinTech solutions.

1.8. Operational Definition of Terms

FinTech (Financial Technology): Refers to the application of technology to improve financial services, including risk management, payments, lending, and customer service.

Risk Management: The process by which banks identify, assess, mitigate, and monitor risks associated with credit, operations, compliance, fraud, and cybersecurity.

Commercial Banks: Financial institutions that accept deposits, offer checking account services, and make various loans.

Compatibility: The degree to which FinTech solutions align with existing practices, values, and technological infrastructure within Ethiopian banks.

Regulatory Support: The assistance, policy frameworks, or favorable regulations provided by regulatory bodies such as the National Bank of Ethiopia to facilitate FinTech adoption.

Emerging Market: Refers to economies in the process of rapid growth and industrialization.

Fraud Detection: The process of identifying and preventing fraudulent activities, including unauthorized transactions, identity theft, and financial crimes.

Compliance: Adherence to local and international regulations, guidelines, and standards.

1.9. Organization of the Research Report

Study report is to be divided into five chapters. The first chapter discusses the study background, problem definition and the objective of the study, research questions and scope and importance of the study, the limitations of the study, the definitions of used terms and the research plan.

Second, a literature review chapter, empirical study, the theoretical background of the issues of digital payment adoption by the user, and the conceptual framework will be reported in the chapter.

In the third chapter, data formats and sources used in the current study will be justified, a procedure for choosing the statistical data analysis1) techniques will be described, and a method for data acquisition will be explained.

Fourth chapter will expose the description of the analysis of and the results of the study that are produced with descriptive and inferential statistical procedures.

The following conclusion and recommendation of the entire study will be described in the last section.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The literature review chapter provides a theoretical and empirical foundation for understanding the relationship between FinTech and risk management in banking. It begins by defining FinTech and discussing its evolution, highlighting key innovations such as AI, machine learning, blockchain, and digital banking solutions. The chapter then explores global trends in FinTech adoption, emphasizing its impact on financial services and risk management.

Following this, the chapter examines traditional risk management frameworks and their limitations, demonstrating the need for FinTech-driven solutions. It discusses how FinTech enhances risk identification, predictive modeling, fraud detection, and regulatory compliance. Additionally, the challenges associated with FinTech adoption including cybersecurity risks, regulatory constraints, infrastructure limitations, and ethical concerns are critically analyzed. The chapter concludes with an exploration of FinTech's role in emerging markets, particularly in Africa and Ethiopia, to contextualize the study's focus on Dashen Bank.

2.1. Overview of FinTech in the Global Banking Sector

2.1.1. Definition and Scope of FinTech

Financial technology, also known as FinTech, is generally described as the novel application of technology for the creation and provision of financial services. This term includes, among others, mobile banking, peer-to-peer lending, blockchain, cryptocurrency, artificial intelligence, and big data analytics, all playing different financial roles and changing the basis of banking practices (Arner, Barberis, Buckley, 2016; Gomber, Koch, Siering, 2017). Compared with earlier bank technologies (Gomber et al., 2017), FinTech is characterized by the use of digital platforms, analytics and automated processes in order to render financial services more efficient, more accessible and more personalized. FinTech ecosystem comprises start-ups, technology systems and established financial institutions that are changing to maintain effectiveness in a digitalizing world at a high speed.

FinTech comprises many domains, each of which deals with a particular aspect of finance. For example, lending platforms are technologies that match borrowers and lenders without traditional banking middlemen (Bussmann, 2017). Digital payments have revolutionized cash economies by ensuring secure online purchases while in financial planning technologies, AI and ML are leveraged to tailor investments according to an individual's needs (Gomber et al., 2017). These categories encapsulate the multidimensionality of FinTech and its potential to operate at various levels of financial service delivery, and thus to transform the worldwide banking landscape.

2.1.2. Historical Development of FinTech

The origins of FinTech lie at the start of the 20th century in credit cards and Automated Teller Machines (ATMs) early forays into bringing tech into banking (Arner et al., 2016). But FinTech as we know it currently emerged at the beginning of the 2000s, following the advent of online banking and digital payment systems.

Since the 2008 financial crisis, there was an explosive growth in FinTech innovation, fueled by regulatory reform, technology changes, and new consumer behavior, which forced financial institutions to embrace new and innovative solutions (Puschmann, 2017).

A pivotal event in the history of FinTech was the introduction of blockchain technology in 2008 by an anonymous person, known also as Satoshi Nakamoto, who introduced this technology by Bitcoin (Nakamoto, 2008). Blockchain, the technology that drives secure, transparent, and trustless information exchanges, has gone on to serve as the foundation for cryptocurrencies and other financial software.

Furthermore, the post-crisis regulatory context favored transparency and operational efficiency of the financial services sector and both banks and non-banks pursued FinTech solutions as a means of cutting costs, optimizing operations, and adapting to evolving customer demands (Arner et al., 2016; Bussmann, 2017).

2.1.3. Global Trends in FinTech Adoption

The doption of FinTech has rapidly spread worldwide as a result of technological innovation, mobile and internet penetration, as well as expectations and desire for individual, convenient, efficient financial services. As noted in KPMG's Pulse of FinTech report, global FinTech investment exceeded $100 billion in 2020, which reflects the sector's exponential growth and investors' conviction that FinTech could transform the world (KPMG, 2021). One of the facilitating trends in FinTech is the rise of mobile banking use, peer-to-peer online lending, and digital wallets, all of which have facilitated access to financial services and participation in the democratization of the traditional banking industry.

In developed countries, FinTech introduction is generally accompanied by the incorporation of artificial intelligence (AI) and machine learning in financial operations. For example, AI-enabled chatbots and robo-advisors cater to the individual customer support needs and to the individual investment advice needs on large scales and reduce operational costs and improve customer satisfaction, (Chen et al 2019). In less developed countries the role of FinTech on financial inclusion is strong, due to the expansion of both mobile money and digital payments that have provided access to core financial services to the unbanked target audience. For example, mobile banking applications, like Kenya's M-Pesa, have played a pivotal role in improving financial inclusion by enabling access to transact across the widest possible financial footprint (Jack, 2016).

Despite these advancements, FinTech's impact is not uniform globally. Historically, however, when evaluating the core economies, the focus has been towards the enhancement of customer experience and capability within the context of the present financial landscape, and in developing economies, FinTech is often regarded as a solution to fill this financial infrastructure and access gap (Kinfack, 2020). Issues such as regulatory readiness, infrastructure readiness and public acceptance greatly influence pace and magnitude of FinTech adoption in different markets (Gomber et al., 2017).

2.1.4. Risk Management in the Banking Sector

Risk management is one of the pillars of banking, due to the inherent risk in which financial companies operate, where credit default, market fluctuation, operational disruptions and regulatory changes could have catastrophic effects on stability. Hence effective risk management is essential to keep the resilience of a bank, protecting customer assets, and to achieve investor back again (Aebi, Sabato Schmid, 2012). This chapter discusses the fundamentals of risk management, identifies risk types that banks encounter, summarizes conventional risk management practices, and identifies weaknesses of such practices in the current rapidly changing financial environment.

2.1.5. Definition and Importance of Risk Management in Banking

Risk management in banking is the structured activity of identifying, assessing, mitigating, and monitoring risk which may have a detrimental impact on the operation, brand, or stability of the bank. Because a robust risk management framework plays a key role in maintaining financial stability of banks, regulatory compliance, and shareholders' value (Basel Committee on Banking Supervision, 2019), designing it is of the highest importance. In the sense that the Basel Committee has established, effective risk management practices are an essential part of a bank's ability to operate in a safe and effective manner as markets become more complex and competitive.

The importance of risk management has grown in recent years not only due to the interconnectedness of the global financial market, but also due to the rise of digital financial services. Alongside risk that can come with cybersecurity attacks, operational disruption and shift in market circumstances, cascading effects are possible across economies and especially as digitized business where transactions take place at velocity not before experienced. Active risk management, however, is not only of paramount importance to banks to secure their own assets but also to secure the overall financial system to be stable (Aebi et al., 2012; Jobst, 2014).

2.1.6. Types of Risks in Banking

Banks are subject to a broad range of risks from which different risk management approaches are needed. These risks are typically grouped into credit risk, market risk, operational risk, compliance risk, and cybersecurity risk.

Credit Risk: Credit risk is the risk that the debt borrower will be unable to honor his/her financial commitments and therefore the creditor will suffer a loss. It is one of the most significant risks to banks, especially banks that have a big loan book. Credit risk has always been managed by banks in that creditworthiness of borrowers is determined on the basis of past financial history, income stability, and ability to repay. Yet data from non-traditional sources is generally disregarded in this strategy, and therefore the predictive potential is restricted (Aebi et al., 2012).

Market Risk: Market risk comes from movements in market parameters, such as rates, foreign exchange rates, and stock markets. Market risk can spill over to the capital of investments and loans and other assets for banks.To make effective market risk management possible, smart model-based solution approaches to predict about the change in market dynamics must address the problem that with historical information of the model it might be difficult to describe accurately the future volatility (Basel Committee on Banking Supervision, 2019).

Operational Risk: Operational risk is loss resulting from malfunctioning or total collapse of internal processes, system, or bad operator behavior. Specifically, among the set of problems, system down, data leakage, and fraud etc. Operational risk is highly relevant in the context of digital banking, in which complex IT systems and security data are used by the banks (Kumar Ravi, 2016).

Compliance Risk: Compliance risk is the risk of financial, legal, or reputational injury from a failure to comply with the law, regulations, or internal policy. Regulators are usually quite strict with banks regarding transparency, fairness and financial health. Noncompliance can lead to fines, penalties, and damage to the bank's reputation for compliance risk management, making it a key functional requirement (Gai, Qiu, Sun, 2018).

Cybersecurity Risk: The cybersecurity risk has lately emerged as crucial because commercial banks are using digital platforms and dealing with huge quantities of sensitive information. Cyber security breaches, including data breaches, ransom ware attacks, and phishing, can lead to loss of the customer data, business interruptions and financial losses. Continuous evolution of threats necessitates an ongoing roll out of both security technology and staff training in order to address these evolving threats (Chen et al., 2019).

2.2. Traditional Approaches to Risk Management

Historically, banks have controlled such risk through regulatory compliance, manual processes, and historical analysis. Traditional risk management models have been based upon rules underpinned by regulation, for example, the Basel Committee on Banking Supervision, which has laid down minimum principles for risk management in the banks.

These frameworks establish a benchmark of mandatory standards for capital adequacy, risk reporting, stress testing, and so on (Basel Committee on Banking Supervision, 2019).

Conventional risk-management approaches are largely compliance-oriented, and risk assessments are largely focused on meeting legal requirements rather than on learning and proactively anticipating new and developing risks. For instance, credit risk assessment has traditionally been based on an assessment of the borrower's past track record of creditworthiness, debt obligations and income stability. Although powerful in the sense that it can be used to a different extent on dynamic risk factors or on data sources outside the conventional domain (Jobst, 2014), the approach is not very versatile to be scaled further to consider the aforementioned. Market risk has previously been hedged, but by using statistical models (Value-at-Risk (VaR) and scenario analysis) that predict the maximum loss from past market behavior. But these models suffer from shortcomings when applied to evolving markets because they are highly dependent on historical data and may not provide suitable predictions for future volatility (Aebi et al., 2012).

In addition, operational risks have been traditionally controlled by manual scrutiny and internal controls. In the past, financial institutions followed a set of pre-determined policies and procedures to prevent operational breakdowns which are time-consuming and expensive.

Compliance risk, in turn, has traditionally come to be defined in terms of regulation and policy compliance, and banks have been all too willing to invest significant time and effort into internal audit and compliance reviews. Nevertheless, this approach is often accompanied by voluminous papers, reporting and administrative constraints, which can be a limitation to the early detection of new compliance risks (Ravi, 2016).

2.2.1. Limitations of Traditional Risk Management Approaches

It is undeniable that while traditional risk management practices have been effectively applied for years in the banking sector, there are limitations in today's digital, volatile, and uncertain financial environment of today's bank. Another major drawback is that these techniques are reactive, not proactive. Standard models, however, tend to estimate risk using only past data and in doing so may not account for risks that are emerging or trends in consumer behavior, technological advances, or the global financial markets (Aebi et al., 2012).

Obviously, because of the nature of the data, the script cannot be applied to a large and heterogeneous dataset. Traditional methods of risk assessment for courses rely on formalized financial data, such as income and credit report, and therefore cannot effectively exploit the relevant data that is present in the non-formalized source of data, such as social media or mobile payment history (Gomber et al., 2017). This restricts the reliability and breadth of credit risk evaluations, particularly in developing countries where people may lack formal credit records.

Moreover, traditional risk management frameworks are often resource intensive. The process, for instance (of) achieving regulatory compliance involves the extensive keeping of records, manual auditing and reporting, which, all of which are costly and time consuming. Just as smaller banks and especially those in the developing world can be challenging to serve under the necessary regulations alongside the many operational risks (Basel Committee on Banking Supervision, 2019), taking adequate resources to satisfy these regulations may be a challenge.

In order to advance research, one of the conventional approaches is not sensitive enough to handle cyber security attacks. Cyber security risk management is becoming more and more important in digital banking in view of the continuing growth of the sophistication and frequency of cyberattacks. However, traditional security mechanisms may prove to be ineffective against modern attacks, and banks generally require real-time tracking, predictive analytics, and intelligence-driven detection systems in order to remain secure in the face of continuously changing risks (Chen et al., 2019).

2.3. FinTech's Role in Modernizing Risk Management

Whilst financial technology (FinTech) providers are evolving, they offer purchasing order tools to banks that provide risk management functions that extend beyond the compliance-only BAU of the traditional approach. FinTech innovations address the limitations of traditional risk management by enabling more proactive, data-driven, and agile approaches to risk identification, assessment, mitigation, and monitoring. Here, we will address the role of FinTech in enhancing risk management practices by using better data processing, predictive analysis, and real-time monitoring techniques and others.

2.3.1. Proactive vs. Reactive Risk Management

One of the primary advantages of FinTech in risk management is its ability to shift from reactive to proactive strategies. Classical risk management is predicated on historical records and post-incident analyses and has a lag in response to the lurking risks. On the other hand, FinTech instruments, such as artificial intelligence (AI) and machine learning (ML), allow banks to understand and mitigate risks proactively (Puschmann, 2017).

Machine learning algorithms analyze large datasets, identifying trends and anomalies that may indicate potential risks, such as fluctuations in customer spending behavior or unusual transaction patterns (Chen et al., 2019). This predictive capability allows banks to implement preventive measures and reduce the likelihood of financial losses, fraud, or security breaches.

For instance, banks making use of AI-based risk models can train for subtle aberrations in customer behavior-e.g., an abrupt drop in the number of accesses to an account-that point towards financial distress or fraud. The use of the active method is particularly important in the present complicated financial world in which, because of the incredibly rapid evolution of risks, traditional, and heteroskedastic risk models still lag behind (Gai, Qiu, Sun, 2018). Proactive risk management, with the capacity for banks not just to maintain themselves economically resilient, but also to increase the trust of their respective clients by reducing the likelihood of large-scale failures.

2.3.2. Enhanced Risk Identification and Real-Time Monitoring

FinTech tools are very effective at step of risk identification because they deal with vast numbers of structured/unstructured data from multiple sources (eg, social media, transaction log, and external market data). Simultaneously, machine learning algorithms are capable of making real-time transaction data analysis to identify anomalies that indicate fraud or cyber-attack. In the case of real-world applications, risk control models in practice are almost always able to use internal data and are not able to make effective use of external real-time inputs. On the other hand, the data integration capabilities of FinTech enable a wider understanding of risk drivers, in turn a better identification and anticipation of the new risks (Bussmann, 2017).

Also, big data analytics have been an essential part of risk monitoring, allowing banks to spot hidden patterns and correlations in data that could not be seen through traditional approaches. Among other things the big data models, e.g., can monitor trading behavior, market sentiment, the current popularity, i.e. market sentiment and geopolitics in order to predict the volatility of market risk (Gomber, Koch, Siering, 2017). This is particularly useful in credit risk management when standard credit scoring models may not adequately capture sudden changes in borrower risk status. Real-time data-based analysis allows banks to react more flexible and data-driven than before to adjustment of risk models and policies.

Real-time surveillance is also of extreme relevance for operational risk management, particularly cyber security breaches. As digital platforms are used in large scale operation by banks, cyber-attacks (ransom ware, phishing, data breaches) have become a top concern for security (Chen et al., 2019). FinTech tools provide continuous monitoring of network activity, alerting banks to unusual access attempts or suspicious transactions as they occur.

This can enable the banks to react quickly to possible attacks, minimize damage, and protect customer data.

2.3.3. Improved Credit Scoring and Inclusive Lending

Credit scoring, as an important part of risk management, has traditionally relied on only a small amount of information about financial history, credit, and income. This method often subjects "large populations" to exclusion, and in particular countries of low development, in which the formal financial records of the individuals may be absent. FinTech, on the other hand, enables fairer credit scoring by obtaining alternative data, namely the mobile phone activities, social media activity, and bills, used (Gomber et al., 2017). Machine learning algorithms process these heterogeneous data samples and hence banks can predict the creditworthiness of loan applicants that would not have been taken into account based on classical scoring models (Puschmann, 2017).

Using the criteria expanded as in credit scoring, FinTech brings about financial inclusion that enables underbanked communities access to loans, credit, and other financial services.

Evidence from research suggests that alternative data-based credit scoring can be just as accurate as traditional credit scoring while at the same time it enables institutions to extend the scope so that the concentration risks are less (Jack, 2016). Moreover, more accurate credit scoring models reduce the incidence of default by allowing banks to gain a more accurate insight into the financial behavior of each borrower.

2.3.4. Fraud Detection and Cyber security

In the past, fraud detection relied on ruleset-based systems that detect questionable transactions based on a pre-defined set of criteria such as the very high number of purchases or withdrawal.

However, they are limited in their ability to understand sophisticated, adaptive, fraud schemes. FinTech applications for fraud detection have incorporated artificial intelligence (AI) and machine learning (ML) to detect anomalous patterns in real time that dynamically respond to emerging fraud schemes (Gai et al., 2018). For example, machine learning models can detect anomalies in transaction logs (e.g., multiple purchases of small values made by a user from far locations that can be suspected of fraud). Algorithms continuously improve with more data, and consequently fraud detection systems tend to improve over time (Chen et al., 2019).

Blockchain technology also serves to provide security and to support crime prevention. Being an immutable, decentralized ledger, blockchain stores transactions in a auditable and secure way and thus mitigates the possibility of forgeries or any unauthorized amendments. Banks can leverage blockchain to create non-rewritable proof of a transaction, which is especially useful in contexts such as trade finance, where document fraud and duplication are both known risks (Gomber et al., 2017). In addition, blockchain technology can enable banks to use smart contracts - self-fulfilling (self-enforcing) contracts within which the conditions are already coded - that ensure compliance and reduce the risk of fraud (Nakamoto, 2008). In the case of, for instance, trade finance, a smart contract could automate, for example, delivery of payment when certain conditions, e.g., receipt of goods, are met, in what it is argued, is a very low risk of human error and fraud.

2.3.5. Transparency and Trust through Blockchain

Blockchain technology enhances transparency and trust by giving the guarantee of data integrity and accountability to financial processes. Due to the peer-to-peer nature of block chain transactions and the cryptographic integrity of the block chain, block chain transactions provide a reliable channel for banks to verify transaction logs via intermediaries (Nakamoto, 2008). There are even some benefits to this level of transparency in the field of compliance and in anti-money laundering (AML) practices, which is where the history of transactions needs to be audit-traceable and auditable at a granular level.

Specifically, banks can use block chains to annotate fund origin on AML queries to verify the compliance to legal requirements and reduce money laundering risk. The tamper-proof aspect of the blockchain allows that regulators and auditors verify the transaction history of assets, another layer of accountability (Puschmann, 2017). The use of blockchain further enhances customer confidence, as blockchain guarantees clients that their data is safe and that transactions take place openly.

2.3.6. Cost Efficiency and Scalability through Cloud Computing

Cloud computing is one of the key innovations of FinTech, which makes it possible for banks to effectively store data, run applications and scale computing resources. Cloud technology can obviate the need for expensive on-premises hardware, allowing financial institutions to provide and use as and when required the resources available (Gomber et al., 2017). This reach for cost efficiency is even more critical for the smaller banks or banks in the less developed countries where funding for IT infrastructure is scant.

Furthermore, CSC allows advanced data mining and real-time tracking by making available on demand storage and processing capacity. Specifically, banks can use big-data and deep-learning without a significant initial hardware investment. Built-in security features (e.g., encryption, identity and multi-factor authentication) are widely offered by cloud providers to help banks comply with data privacy and security laws (Arner, Barberis, Buckley 2016). However, data privacy and third-party risks issue still, so the banks need to adopt rigorous security measures to fully enjoy it in cloud computing.

2.4. Challenges in FinTech-Driven Risk Management

Yet despite the great potential contribution of FinTech innovations, which, ultimately, offer considerable advantages in reengineering risk management practices, such innovations entail many challenges and difficulties. The arduous task of managed implementation of FinTech is a process of balancing the risk of computer attack, legal and regulatory obligations, hardware software limitations and financial implications.

In this chapter, these roadblocks are described within the scope of giving an idea of threats and challenges that may impede the development of FinTech toward risk management.

2.4.1. Cybersecurity Risks

Cyber security is a very important issue in fintech and banking. However, as banks, cloud storage, online payments and digital customer data grow up on digital platforms, digital attackers perceive these as a prize to be grabbed hold of (Gai, Qiu, Sun, 2018). FinTech technologies - mobile banking, digital payments, and blockchain - have introduced new vulnerabilities, and attacks on financial institutions have become increasingly sophisticated in scope (Chen et al., 2019) such as ransomware, phishing, and identity theft. With cyber security threats becoming more and more sophisticated, so do the security responses and many banks, particularly small ones, may be unable to finance or effective in implementing the response properly.

For instance, although block chains have been argued to be unassailable due to their decentralization, block chain-based systems are not necessarily immune to attacks (e.g., 51% attacks or attacks on smart contracts, which are susceptible to flaws) (Gomber, Koch, Siering, 2017). Further, machine-learning models used for fraud detection can be susceptible to adversarial attacks, i.e., attacks where a threat actor manipulates samples that fool a model. These difficulties highlight the necessity for financial institutions to put money into highly advanced cyber security defenses such as encryption, multi-factor authentication, and real-time network surveillance to defend against progressive cyber threats.

Cybersecurity attacks, even if leading to just loss of money, also damage customer trust, the company brand and in extreme cases can get penalties by regulating agencies.

According to the research, customer concerns about data privacy and security are identified as the key factor in the prevention for FinTech maturity, and thus, cybersecurity is natural focus for banks to use FinTech for risk management (Gai et al., 2018).

2.4.2. Regulatory Challenges

FinTech innovation tends to precede the development of regulatory framework, and there is a delay because technology adoption and regulatory responses takes time. Banks are being asked to balance delivering us their existing compliance and adopting (FinTech) which might not yet be fully addressed in policy. For example, privacy laws in data, such as the General Data Protection Regulation (GDPR) across the European Union (Arner, Barberis, Buckley, 2016) require that information stored in the cloud be treated with strict scrutiny, which is challenging to ensure when using cloud storage, AI (and other innovations in FinTech) to process vast streams of sensitive data.

Regulatory sandboxes for FinTech in several developing countries, e.g., Ethiopia still have their infancy. Regulatory risk associated with the "uncertain" is also a constraint on the confidence of the banks to adopt more technologies, as law alterations could involve potential compliance risks. Furthermore, (consumer) laws to constrain consumer abuses, i.e., anti-money laundering (AML) and know-your-customer (KYC) laws, increase compliance burdens unless proper mechanisms are used that could limit the flexibility of FinTech-based models (Kinfack, 2020). In some cases, aberrant regulation can stifle innovation by, for instance, the use of some FinTech should be expensive because of the compliance costs or may even get entangled in enforcement issues.

Finding the right equilibrium between innovation and regulation is particularly challenging in the stochastic domain of blockchain and cryptocurrency, where potentially anonymous and untraceable transactions could pose a challenge to compliance. Regulatory authorities globally continue to figure out how to license cryptocurrencies and blockchain transactions, which generates uncertainty for banks who are interested in applying these technologies for risk management or investment purposes (Puschmann, 2017). For banks, the adoption of emerging FinTech solutions while keeping compliance with changing regulation demands is an ongoing "watchful" process, which is often driven by substantial legal expertise.

2.4.3. Technical Limitations and Infrastructure Challenges

The successful uptake of FinTech relies upon strong technical infrastructure, such as fast internet, secure data storage and grid power. Nevertheless, the majority of the banks especially in the developing countries are facing the technological limitations that may hamper the effective implementation of FinTech solutions (National Bank of Ethiopia, 2020). In countries where the digital network is not pervasive, banks may struggle with data connectivity issues, the low Internet or underutilization of cloud services, which can be a significant barrier to real time and digital transactions.

By contrast, some FinTech applications (e.g., big data analytics and AI) need CPU, and scalable storage, capacities, and high-performance hardware, which is costly for banks with limited budgets. Smaller institutions may struggle to support large-scale data processing and analysis due to the required investments in infrastructure and may therefore be at a disadvantage compared to larger financial institutions with greater resources (Gomber et al., 2017).

The lack of technical expertise is another significant limitation. Most areas demand the creation and/or the coordination of cutting-edge technologies (e.g., Artificial Intelligence, machine learning, blockchain), but performing this work also demands a special skillset and perhaps restricted and specialized skills. Banks have a need to allocate resources toward staff training and staffing suitably skilled staff to manage these systems, data security and compliance with the law. This skills gap can result in barriers in the implementation process, which can cause delay or stagnation in the integration of FinTech into risk management frameworks (Chen et al., 2019).

2.4.4. Cost Considerations and Financial Constraints

The use of FinTech solutions in risk management is not without financial costs, as they would require high investment costs for upgrading the infrastructure, the security of advanced technology and staffing of qualified professionals for the same in the bank. As the cost for FinTech roll-out in smaller or emerging markets has been financially unaffordable, smaller institutions have been restricted from participating in the commercial value chain of FinTech for larger institutions with higher financial independence (KPMG, 2021).

Such disparity can result in a competitive disadvantage, such that only the large-capitalized banks are able to afford the most modern FinTech technologies while the rest remain stuck using their traditional, mostly older risk management paradigm.

Cost considerations extend beyond initial implementation. FinTech applications generally need constant updating, securing, and sustaining for their continued operation. Cloud computing services, for instance, provide cost savings in terms of data storage and scalability, whereas they come with the necessity of regular upgrades, security checks and compliance monitoring which increase the cost of the long run (Arner et al., 2016). In particular, some technologies, such as delivering blockchain, at a point of use can in turn require high power-usage, thus leading to a marked running cost burden when banks attempt to realize the benefits of such technologies.

By partnering with FinTech companies or outsourcing some activities (e.g., storage) to external service providers (e.g., cloud storage or fraud detection) savings on banks can be realized. However, the risk factors of outsourcing are its link and the feasibility of vendor, and the third-party link for the function of the core. This is a key factor, since the bank needs to be assured that contract vendors comply with data security, privacy and regulatory requirements to ensure the bank and its clients to be safe (Puschmann, 2017).

2.4.5. Privacy and Ethical Concerns

Banks' deployment of artificial intelligence, machine learning and big data analytics for risk management purposes inevitably involves the collection and analysis of huge amounts of personal and transactional data. Due to the sheer amount of data that is being generated, privacy and ethical considerations can arise and raise doubts in consumers as to which information regarding them is being collected, stored and disclosed1. Privacy concerns are pressing matters in jurisdictions with strong data protection laws (e.g. The general data protection regulation (GDPR) which is characterized by stringent requirements on data collection, processing and disclosure (Gai et al., 2018).

Ethical issues and anxieties related to AI/machine learning also present risks and challenges. E.g. (e.g., artificial intelligence (AI) algorithms in e.g. credit scoring and e.g. fraud detection) can exacerbate biases unless they are subject to ongoing scrutiny.

Algorithms have also been shown to present gender, race, or SES biased behavior and lead to negative outcomes for certain subpopulations of the customer base (Gomber et al., 2017). Ensuring that AI systems are transparent, explainable, and free from discriminatory biases is essential, as biased algorithms not only create reputational risks for banks but also raise ethical and legal concerns.

Banks will also have to consider these privacy and ethical considerations and implement data governance frameworks that specify policies around data access and use, informed consent and data transparency. More specifically, banks are requested to form groups of people with responsibility for ethics and design, development and deployment of AI-based systems to prevent discriminatory and unfair treatment of all customers (Chen et al., 2019).

2.5. FinTech in Emerging Markets

FinTech is a special context in developing countries, where opportunity/threat is different from that in developed countries.

Financial technology (FinTech) has the potential to be a lens through which long-standing financial access barriers are addressed, economic incorporation is enhanced, and innovative risk-adjusted technology is developed in environments where traditional banking infrastructure is absent. Indeed, the spread of FinTech in the emergent countries is also penalized, for example, due to regulation gaps, infrastructural capability, and socioeconomic limitations. This paper examines the innovative potential of FinTech for emerging economies, especially with respect to the arena of financial inclusion, adoption barriers and regulatory reframing.

2.5.1. FinTech's Impact on Financial Inclusion in Developing Countries

One of the benefits of FinTech in the developing world is its contribution to financial inclusion. People in those locations are often cut off from conventional banking due to lack of location, economics, or technology/technical reasons. FinTech applications, in the form of mobile money, e-payment, etc., at least partly addressed this gap and offered a suite of services to the unbanked population, the so-called, unbanked underserved segments (Suri Jack, 2016). For example, mobile providers of a store of value, including e-money platforms, like M-Pesa in Kenya, give customers the ability to bank money on their cell phones, without the need for an ordinary bank account (Suri Jack, 2016). The adoption of M-Pesa has fuelled similar initiatives in other African countries, inferring the potential of the scale-up and effect of mobile money on financial inclusion.

FinTech also contributes to financial inclusion by offering alternative credit scoring options, allowing lenders to estimate if individuals can be considered creditworthy, despite a lack of formal financial history. Yet, the mainstream credit scoring algorithms are all too much based-on credit history, for which many of, say, the population in developing countries is not even available. FinTech applications, however, also use other data sources, e.g., movement of a mobile phone, payment of gas and electricity bill, web surfing, etc., to build a richer risk profile (Gomber, Koch, Siering, 2017). This model can be applied to enable financial institutions to reach down and to lend to those traditionally excluded from the scope of formal lending infrastructures, thereby accelerating entrepreneurship and economic development.

FinTech aside, it is not only a promotion of traditional financial services, in fact FinTech encourages economic empowerment by recommending saving, insurance and investment options to disadvantaged segments. It has been suggested that mobile banking/digital payment account is associated with increased financial resilience and higher revenue-generating activities because individuals have improved capacity to save and invest as well as effectively-manage funds (Kinfack, 2020). In most of the poor countries, these are not only financial tools, but also the key tools for social or economic development, poverty reduction and inequality evasion.

2.5.2. Challenges in FinTech Adoption in Emerging Markets

Nevertheless, due to its potential, FinTech is facing difficulties in its implementation in developing countries. Therefore, absence of infrastructural barriers is an essential metric, as many areas lack digital connectivity, power supply, and steady data storage facilities to sustain FinTech applications (National Bank of Ethiopia, 2020). There is a large difference in mobile and Internet penetration in developing countries, which thus restricts the scope and scale of digital FDs. In developing countries, infrastructure may not be available for the banks' and FinTech's operation for continuous provision of services, particularly at rural level.

Socioeconomic constraints also affect FinTech adoption. There may be a segment of the population in the emerging market at a low level of digital literacy and financial literacy and thus not able to benefit from FinTech solutions. Given that some target users are unfamiliar with the technologies on which digital banking is based, not to mention the lack of trust in the digital banking system, it is probable that many users will be behind the times in adopting the service. Insufficient financial literacy exacerbates this problem, as individuals may be hesitant to enter financial products if they do not understand how these products function (Kinfack, 2020). Education and outreach programs are often necessary to promote awareness and build trust among underserved communities, yet such initiatives require time, resources, and collaboration between the public and private sectors.

Regulatory challenges represent another obstacle. Regulatory mechanisms in several developing countries are still underdeveloped to meet the pace of FinTech innovations, and this introduces new challenges for financial as well as for technological sectors. The regulatory landscape varies in some countries to an extreme degree that it prevents innovation, and in other countries it is to an insufficient level which does not safeguard consumers and market stability. For example, regulatory uncertainty around data privacy, cybersecurity and digital identity assurance can deter the use of FinTech solutions by financial institutions because banks are concerned about possible liability and compliance risk (Arner, Barberis, Buckley, 2016).

FinTech development and maintainability are further limited in developing countries by financial constraints. Smaller banks and financial institutions may be unable to allocate the capital necessary to deploy cutting edge technology, cybersecurity, and human resources. This resource shortage leads to a disparity in FinTech adoption between institutions with extensive capital and the ability to use technology for service enhancement, and institutions with limited capital and confined to traditional banking activities (Gomber et al., 2017). As an alleviative measure to these financial difficulties, a number of countries have started to encourage public-private partnerships (P3s) or grant money to re-finance the rollout of digital infrastructure.

2.5.3. Comparative Analysis of FinTech Adoption in Africa

FinTech is widely shown to have great potential to be a catalyst for financial inclusion in Africa, specifically in Kenya, in Nigeria, and in South Africa. In developing countries, M-Pesa is the model for mobile money use, and there is more than 90% of the adult population using the system to access the database through financial transaction, the payment of bills, and financial saving (Suri Jack, 2016). The M-Pesa's success has also demonstrated the ability of mobile technology for the ancillary rural and underserved populations as well as that of sharing financial services with the underserved rural populations that have been hitherto restricted to urban environments with adequate bank infrastructure.

Nigeria, the most populous country in Africa, is also at the forefront of big FinTech developments, including digital money, lending, and remittances. Nigerian FinTech firms, such as Paystack and Flutterwave, have thrived because of mobile and internet penetration that have enabled payment flow paring and the emergence of new options in cross-border payments (National Bank of Ethiopia, 2020). Nevertheless, the regulatory landscape in Nigeria has been troubled, particularly around regulation of cryptocurrencies, data privacy, and AML. Regulatory changes are evolving to find the right balance between innovation and consumer protection, despite this, as well as in areas such as blockchain and digital money (Puschmann, 2017), there is still a degree of uncertainty.

South Africa, being an advanced economy in Africa, possesses a more mature banking base and a more supportive regulatory environment that is favorable to FinTech. However, income and digital access discrimination continue to serve as a roadblock to equitable FinTech adoption. FinTech technologies in wealth management, digital payments, and risk management have been implemented by South African banks, which are examples of the replicating of such technologies in markets with more sophisticated infrastructure. The formation of a FinTech unit at the South African Reserve Bank has led to a proactive way towards FinTech regulation, even if that included experimentation with regulatory sandboxes and encouragement of responsible innovation (Arner et al., 2016).

These examples highlight the heterogeneity of FinTech uptake in African countries and suggest that FinTech solutions will need to be tailored to the specific regulatory, economic, and infrastructural context of each nation. The following Ethiopian’s' FinTech environment described below include both challenges and opportunities, which are typical on the regulatory and socioeconomic level of Ethiopia.

2.6. The Ethiopian FinTech Landscape

The financial technology (FinTech) industry in Ethiopia is in its early stage of development which presents a big opportunity, but also a very urgent one. Ethiopia, one of the fastest-growing economies in Africa, has shown an extensive demand for financial services, but the banking sector remains relatively immature compared to regional rivals, such as Kenya and Nigeria (National Bank of Ethiopia, 2020). Due to limited access to conventional banking, a high mobile penetration rate, FinTech can serve as a valuable tool to address financial inclusion and strengthen risk management in Ethiopian banks. However, there are some unique regulatory, infrastructural, and socioeconomic barriers in Ethiopia that affect FinTech adoption. In this part, the present situation of FinTech in Ethiopia is discussed considering development trends, regulatory environment as well as case studies, local financial institutions like Dashen Bank are considered.

2.6.1. Development of FinTech in Ethiopia

In recent years, the FinTech industry in Ethiopia has witnessed development, mainly fueled by mobile banking, digital payments and online banking. Specifically, mobile banking has been put forward as a prominent service, which can provide customers with banking services through a mobile phone without visiting their physical branch (National Bank of Ethiopia, 2020). With growth in mobile and internet penetration, mobile banks have the potential to interface with previously unbanked populations and even more geographically rural user segments. Digital payment systems, e.g., Telebirr, M-Pesa and HelloCash, have also provided financial services to Ethiopia's underserved population by means of electronic money transfers, payment of utility, and other charges as well as saving through mobile network technology.

Telebirr, introduced by the State-owned telecommunications enterprise Ethio Telecom, is a mobile money system through which users can make mobile phone transactions. Within a few months, since it is launched telebirr has gained several millions of users, and this proves that telebirr is a manifest example of the growing demand of digital financial services in Ethiopia (Ethio Telecom, 2021). Also, a consortium of Ethiopian microfinance institutions backed project HelloCash aims to mainly provide mobile money services to poor people and micro-enterprises to keep poor people away from a cash-based bank money shop (Kinfack, 2020). These services have also proved central to Ethiopia's efforts to improve access to finance, as, in the case of physical banks, in the cities, the needs of rural populations situated at a distance from finance institutions (such as the banks) can be ignored.

Financial Technology (FinTech) innovation in Ethiopia has also been Influenced by the establishment of digital money companies, FinTech companies, and microfinance institutions, all of which try to fill the gaps of the traditional banking system. However, while these efforts hold potential, FinTech penetration remains limited in some scale, with greater growth outside of providing routine banking services than it is in more sophisticated banking activities like risk management.

Ethiopia's FinTech ecosystem is relatively young, and most local financial institutions still have the burden of traditional methods of risk management by the limitations set by the regulation and the lack of resources (National Bank of Ethiopia, 2020).

2.6.2. Regulatory Environment in Ethiopia

Regulatory framework is a strong determinant for FinTech uptake, and, in Ethiopia, the regulatory framework is under evolution. The National bank of Ethiopia (NBE), as the lead regulatory body in the financial sector, adopts a prudential approach to FinTech regulation and seeks to reconcile FinTech innovation and financial stability.

The NBE has already instituted policy measures to facilitate digital money transfer and mobile banking (National Bank of Ethiopia, 2020), although a legal framework that can cater for more sophisticated FinTech solutions such as blockchain, artificial intelligence (AI) and machine learning (ML) is still to be developed which can bring novel enhancements to the risk management practices (National Bank of Ethiopia, 2020).

In 2020, the NBE cleared the Mobile Money Regulation, opening the door for non-bank entities to deliver mobile money services and for non-traditional financial entrants such as Ethio Telecom to compete in space. This prescription was an important step towards financial inclusion by improving access to mobile financial products. However, data protection, cybersecurity, and identification verification (likely to be crucial for preventing digital commerce ability to breach digital exchanges as well as for safeguarding customers' data) (Kinfack, 2020) still hold regulatory gaps. Without a comprehensive regulatory environment that addresses these issues, banks and FinTech companies enter pressured situations to "stand up and deliver" technologies that need strong data security and compliance control.

Furthermore, due to the high capital and licensing requirements, foreign FinTech companies are not easily able to establish in Ethiopia, there is limitations of Ethiopia's ability to access FinTech knowledge and capitals from global market. Although these protective measures are aimed at the protection of the domestic market, they, in turn, also stifle innovation due to lack of competition and to the reluctance to implement new FinTech solutions (Puschmann, 2017).

Regulatory uncertainty for technology in Ethiopian banks is causing reluctance to adopt such technologies as blockchain, artificial intelligence, machine learning, etc., in support of risk management because of the definitions of the technologies that they currently represent to name a few.

2.6.3. Infrastructure and Technological Limitations

Though Ethiopia's digital infrastructure is still evolving, it continues to fall short of most of the other African countries regarding the acceptance of FinTech. In the country, the telecommunication sector was classified as a monopoly, controlled by the state-owned Ethio Telecom that was limiting competition and impeding Internet and mobile network rollouts. Although new legislation has been put in place to break up the telecom market, the availability of digital connectivity varies, particularly in rural regions (Ethio Telecom, 2021). This infrastructure Gap constrains the power of mobile banking and digital payment systems, as a ubiquitous and high standard of connectivity is needed to support FinTech service.

Additionally, the infrastructure for FinTech adoption is usually also missing within Ethiopia's banks. For advanced FinTech applications (e.g., big data analysis, artificial intelligence, and blockchain), the IT infrastructure, data transferring rate, and cybersecurity across FinTech applications should also be competent. Notably, smaller institutions specifically would not have the means to make use of these technologies and therefore become reliant on the traditional risk management practices (Gomber, Koch, Siering, 2017). The absence of trained personnel with expertise in the fields of data analytics, cybersecurity and FinTech development increases the complexity of the issue as there is a competitive situation for Ethiopian banks to recruit and retain professionals qualified to operate and optimize FinTech systems (Chen et al., 2019).

2.6.4. Case Study: Dashen Bank and FinTech Adoption

As an example, the lending capacity, scalability, risks, returns, social, cultural and technological factors of Dashen Bank, one of the largest and technologically most advanced banks in Ethiopia, make Dashen Bank a relevant empirical case study to examine the adoption of FinTech in Ethiopia. Established in 1995, Dashen Bank has taken significant steps in delivering digital financial products and services, such as mobile banking and digital payment, to the company (Dashen Bank, 2021). A combination of FinTech solutions is developed to achieve customer experience and financial services delivery in an urban and rural setting. Dashen Bank's digital financial services online (mobile/internet) allow customers to buy or check their account balance or make online payments.

Nevertheless, the bank Dashen is confronted with the task of using more sensitive FinTech instruments for risk management, such as AI driven fraud detection, or blockchain based transaction validation. Currently, however, neither of these technologies have been implemented to the fullest at the bank due to lack of infrastructure, regulatory, and resource impediments. The experience of Dashen Bank highlights the typical challenges involved in achieving an expansion of Ethiopian banks out of the comfort zone of their established risk management frameworks in an environment of regulatory uncertainty and technical constraints of their infrastructure.

Fintech applications used by Dashen Bank are primarily designed to Customer service and financial inclusion, with risk management as secondary consideration. Although the efficiency of operation of the bank has been helped by digital banking and mobile payment systems, risk management of the bank remains a task of an amateur background. This experience of Dashen Bank underlines the necessity of tailored legislative flexibility and an investment in infrastructure to support the use of advanced FinTech applications in risk management (Dashen Bank, 2021).

2.6.5. Government Initiatives and Public-Private Partnerships

Recognizing the potential of FinTech to drive economic growth and financial inclusion, the Ethiopian government has initiated public-private partnerships (PPPs) and regulatory adjustments to support digital transformation. The recent liberalization of the telecommunications sector is an example of the government's efforts to improve digital connectivity and create a favorable environment for FinTech growth. By allowing foreign companies to enter the telecom market, Ethiopia aims to improve network coverage, reduce costs, and promote innovation in digital services (Ethio Telecom, 2021).

The NBE is also considering regulatory sandboxes, which provide FinTech companies with the opportunity to test new products and services in an experimental setting with limited regulatory protection for a limited period. A number of avenues of collaboration and opportunities are opened by these sandboxes in which novel technologies such as risk management, fraud detection, and customer services could be explored, without the need to deal with existing regulatory barriers (National Bank of Ethiopia, 2020). Although these initiatives are promising, they require sustained support, clear regulatory guidelines, and collaboration between government agencies, banks, and FinTech firms to be effective.

2.6.6. Risk Management Practices in Ethiopian Banks

Risk management is one of the key tasks of commercial banks worldwide and vitally important for Ethiopian banks, particularly considering the evolving environment of the Ethiopian banking sector, which is subject to regulatory oversight, market volatility, and, to a lesser extent, technology infrastructure. Ethiopian commercial banks are faced with various types of risk, including credit risk, operational risk, regulatory/compliance risk or cybersecurity risk, all of which require a tailored risk management approach. Currently the overwhelming majority of Ethiopian banks operate a risk management model predicated on risk regulatory compliance, internal control, and manually managed system process (National Bank of Ethiopia, 2020).

However, all these methods have limitations in a data-rich world and FinTech is already positioned to address these limitations by providing data-driven, efficient, and preventative risk management instruments.

2.6.7. Current Risk Management Frameworks in Ethiopian Banks

The risk management constructs taken by Ethiopian banks are largely the product of regulator pronouncements of the national bank of Ethiopia (NBE). The risk management directions of the NBE mainly focus on the adherence to regulatory standards, requiring that banks maintain sufficient capital, go through periodical audit procedures and submit complete reports on their risk profiles (National Bank of Ethiopia, 2020). Although these processes promote financial stability, they are extremely compliance focused, and largely iterative, repetitive (manual) data operations and historical data rather than complex predictive analytics and automated monitoring software.

The majority of Ethiopian banks assess the credit risk using traditional methods, i.e., credit scoring based on income and credit history. There is good success for this methodology for customers with complete credit records, but it ignores the risk for individuals and SMEs who have no access to mainstream financial services. As a result, banks can implement a systematically biased estimate of risk about certain segments, thereby limiting access to credit to the underbanked (Ravi, 2016). Additionally, Ethiopian banks are mitigating operational risk through implementing internal policy and procedures to prevent process disruptions, fraud, or human errors. However, in such policies, manual inspections are typically conducted only on rare occasions, when the potential risk might not be detected (perhaps because the system does not adequately detect emerging risks) or trends of potential fraud are not detected in real time.

In the context of compliance risk, Ethiopian commercial banks expend considerably on internal audit (i.e., personnel training, documentation, etc. to keep up with Ethiopian regulatory requirements. Compliance procedures are generally very time-intensive and paper-based, and banks face a common challenge of maintaining an extensive and granular record of procedural, transactional, and control process for litigation-prevention. The expense of this approach may, however, restrict the responsiveness of the bank to emerging needs of regulation, particularly when the bank faces new kinds of compliance requirements, such as data privacy and cyberspace security (Basel Committee on Banking Supervision, 2019).

Cybersecurity risk has also been recognized as a major problem, with Ethiopian commercial banks employing digital platforms and Internet banking facilities. Nevertheless, owing to lack of infrastructure and expertise, CB in most Ethiopian banks is still nascent. Basic security measures such as firewalls and password systems are in common use but prove insufficient to protect against these contemporary cyber-attacks (Chen et al., 2019). Inconsistent real-time audit and insufficiently advanced cybersecurity measures of Ethiopian banks make them vulnerable to cyber-attacks, which lead to data leaks, economic damage, and reputational harm.

2.6.8. Limitations of Traditional Risk Management Approaches in Ethiopia

It is noted that while traditional risk management frameworks provide a baseline level of protection, they suffer from a number of limitations in the contemporary digital and networked financial world in which they operate. One important limitation is the reactive nature of standard risk management, i.e. Ethiopian banking enterprises are generally to identify and mitigate risk only if and when the risk is material, thereby forcing them to adopt a reactive stance in matters of risk management. This is especially problematic for managing credit and operational risks, as reliance on historical data and manual reviews may not capture evolving risk patterns or emerging threats (Jobst, 2014).

One limitation of the system is the very high level of human-in-the-loop process that is labor-intensive and error-prone. Manual risk assessment and compliance checks require significant time and labor, and errors or omissions in these processes can lead to inaccurate risk evaluations.

This reliance on manual labor raises the potential for scaling risk management activities in banks in Ethiopia as they expand and increase their delivery of digital services. Furthermore, the absence of automated systems means that banks are not equipped to deal with real-time analysis of large data sets, at least which, if the fraud and cybersecurity implications are to be understood in the cloud, are at least needed (Kumar Ravi, 2016).

Ethiopian banks also face data limitations due to, on the one side, lack of specific link between classical and alternative data sources (e.g., mobile money using data, online social practice data, utility bill data), and, on the other, data unavailability. Traditional credit scoring techniques are limited to credit history and thus do not extend to people without access to formal financial services. This conservative approach not only limits financial inclusion but also gives the bank very little data to apply adequate risk assessment for the rest of the population (Suri Jack, 2016). Lack of an alternative data integration means the Ethiopian banks' ability to carry out holistic credit risk analysis is restricted, to those who are unbanked or underbanked.

Finally, lack of cutting-edge cybersecurity infrastructure and dearth of technology trained and also data analytics professionals in IT industries and data analytics presents serious challenge to effectively manage security risks of Ethiopian banks. Cybersecurity for online banking is complex and growing complex, and some standard security techniques may be insufficient to ensure protection for sensitive financial data. With the expanding use of electronic platforms by the number of Ethiopian banks, a next generation security solution infrastructure also has a need-- such as real-time threat analysis, encryption, and intrusion detection system (Chen, et al., 2019). In the absence of those features, the Ethiopian banks remain vulnerable to cyber-attacks that could lead to leakage of customer data with financial cost.

2.6.9. Potential Role of FinTech in Strengthening Risk Management

The limitations of traditional risk management frameworks underscore the potential role of FinTech in modernizing risk practices in Ethiopian banks. FinTech offers an array of benefits such as real-time data analysis, predictive analytics, and auto-monitoring systems, which has the power to address diverse banking problems facing Ethiopian banks. If Ethiopian banks integrate FinTech into risk management frameworks, they will move from a reactive to a proactive approach, and thus be able to prevent and counter risk, well in advance of its manifestation (Puschmann, 2017).

For example, machine learning algorithms leveraging data analysis of a heterogeneous and potentially rich set of data points, including mobile phone history and utility bills, can lead to more accurate credit risk assessments.

This would enable banks to assess the creditworthiness of individuals without formal credit histories, promoting financial inclusion and expanding their lending portfolios (Gomber, Koch, Siering, 2017). FinTech data integration strengths also enable banks to implement external data in their risk models and enhances the precision of the credit risk assessment as well as allowing banks make better lending decisions.

In operational risk management, FinTech applications, such as real time fraud detection solutions and AI-assisted monitoring tools, could help Ethiopian banks to identify anomalies and fraud events in real time. These methods can detect anomalies in the transactional data (e.g., multiple withdrawals across multiple locations) that can serve as signs of fraud (Chen et al., 2019). The implementation of real-time surveillance provides Ethiopian banks an opportunity to reduce losses arising from fraudulent activities, while at the same time preserving their assets and the customers' trust.

FinTech solutions are also beneficial for compliance and cybersecurity. Compliance automation software facilitates simplification of regulatory reporting and audits by reducing the effort for manual production of documentation and enables banks to adapt to changes in regulation more rapidly (Arner, Barberis, Buckley, 2016). Further, blockchain technology provides an immutable track record, enhancing transparency and accountability, both of which are highly valuable to the anti-money laundering (AML) and know-your-customer (KYC) practices. Decentralization inherent in blockchain guarantees the transaction log records' transparency and inalterability, thereby reducing the risk of fraudulent activity and improving compliance (Puschmann, 2017).

From a security point of view, FinTech-powered tools offer state-of-the-art protection better than a basic firewall and password clearance. Banks can employ intrusion detection systems (IDS), encryption procedures, and two-factor authentication, to protect personal customer data from unauthorized access. FinTech also enables banks to perform constant cybersecurity risk assessments, which reveal vulnerabilities and implement strength on that front against cyberattacks (Gai, Qiu, Sun, 2018). The expensive implementation of these cybersecurity measures is critical to restoring trust between Ethiopian banks and electronic banking companies, as well as to avoid information breaches.

2.7. Theoretical Framework

The Technology Acceptance Model (TAM), Diffusion of Innovations Theory, and Institutional Theory. On their own and in combination, these models help to explain the factors that influence the adoption of FinTech, including perceived usefulness, organizational readiness, and regulatory limitations.

2.7.1. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) (Davis, 1989) has as one of the most popular frameworks for the understanding of the ways in which individuals and organizations accept new technologies. TAM further suggests that two of the most important processes, i.e., percept of usefulness and percept of ease of use, have a significant role in the individual’s reflecting technology acceptance/rejection decision. Perceived usefulness refers to the extent to which technology is considered to enhance job performance, while perceived ease of use reflects the degree to which an individual believes that using technology will be free from effort.

Regarding to Ethiopian banks, TAM provides one perspective on the problems that can support or inhibit FinTech adoption.

When bank personnel and management view FinTech products as helpful for risk management effectiveness, preventing fraud, or compliance, they are more likely to take up FinTech technology. However, if FinTech services are found to be too complicated and too hard to train, there is a risk of resistance to adoption, and for banks if digital literacy is poor (Davis, 1989; Chen et al., 2019).

2.7.2. Diffusion of Innovations Theory

The Diffusion of Innovations Theory, developed by Rogers (2003), explains how new ideas and technologies spread within a society or organization. According to this theory, the adoption of innovation follows a pattern influenced by five attributes: relative advantage, compatibility, complexity, trialability, and observability.

Relative Advantage: This is the perceived gain of innovation versus the traditional solutions. In the Ethiopian commercial banks, however, where a serious benefit of FinTech is identified and it is considered by comparison with the uses of traditional risk management methods, it is planned to use FinTech (Rogers, 2003).

Compatibility: Compatibility refers to the degree to which innovation is sensitive to the organizational values system, to the needs of the organization, and to the operations of the organization. Fintech could be quite popular among banks in Ethiopia if it's accommodated within the boundary of regulation, customary work and institutional goals.

Complexity: Complexity is the perceived difficulty of using innovation. Sophisticated FinTech products that require high levels of training or sophisticated IT infrastructure might not meet resistance in Ethiopian banks, especially in the form of smaller institutions unable to provide technical support (Chen et al., 2019).

Trialability: This property indicates the degree to which an innovation can be tested in a systematic way before it is implemented on a large scale. FinTech pilot projects, such as regulatory sandboxes, allow banks to test new technologies in a controlled environment, thus scale down risk and facilitate adoption (National Bank of Ethiopia, 2020).

Observability: Observability is the visibility of the innovation’s benefits. Banks will be more receptive to using FinTech solutions if they see tangible benefits from risk management results, for example a decrease in fraud or an increase in compliance rates.

2.7.3. Institutional Theory

Institutional Theory examines the effects of regulatory, normative, and cognitive pressures on organizational behavior. This theory argues that organizations adopt new practices or technologies not just for functional benefit, but also in response to need to adhere to industry standards, legal demands, and social demands (2005 Scott). Being highly dependent on regulatory institutions, i.e., the National Bank of Ethiopia, as well as industry standards, the adoption of FinTech in Ethiopian banks is of particular interest to Institutional Theory.

Institutional Theory categorizes pressures into three types:

Regulatory Pressure: This is the force coming from the law and from the regulation agencies.

Normative Pressure: Normative pressure is not only from standards of the industry but also professional skills and cultural prescriptions.

Cognitive Pressure: Cognitive pressure is the impact of consensual beliefs and shared understandings within an industry or job environment.

Institutional Theory is relevant to this study, as it accounts for the reasons why Ethiopian banks may implement FinTech technology beyond utilitarian concerns, and the importance of regulatory and social pressures. When operating in a controlled environment such as Ethiopia's financial world, it is of interest and value to what extent understanding the institutional pressures might illuminate the possible roadblocks to FinTech acceptance and the role of national policy in shaping banks' risk management approaches (Scott, 2005).

2.8. Conceptual Framework

The conceptual framework provides a structured representation of the relationship between FinTech adoption and risk management practices in Ethiopian commercial banks with a particular focus on Dashen Bank. Drawing on insights from the literature on digital innovations in banking and traditional risk management challenges, the framework articulates how advanced financial technologies (e.g., artificial intelligence, machine learning, big data analytics, blockchain) can transform risk identification, assessment, mitigation, and monitoring processes. It further integrates institutional factors that may enable or hinder this transformation.

Key Constructs and Their Relationships

The framework is built around three primary constructs:

FinTech Adoption (Independent Variable):

This construct encapsulates the deployment of digital tools and technologies including AI-based predictive analytics, big data platforms, blockchain systems, and digital payment innovations that are used to support risk management functions. It represents both the extent of implementation and the sophistication of technology integration in the bank's operations.

Institutional Factors (Moderators/Mediators):

Institutional factors include regulatory support, technological infrastructure, and organizational readiness. These factors are critical in determining the ease with which FinTech innovations can be integrated into existing risk management practices.

Regulatory Environment: The extent to which policies and compliance requirements (e.g., from the National Bank of Ethiopia) either facilitate or restrict innovative risk management practices.

Technological Infrastructure: The quality and robustness of IT systems and data connectivity that support advanced FinTech solutions.

Organizational Readiness: The level of staff expertise, financial resources, and the overall strategic orientation toward innovation within Dashen Bank.

Risk Management Outcomes (Dependent Variable)

The outcomes reflect improvements in key risk management functions specifically in risk identification, risk assessment, risk mitigation, and continuous risk monitoring. Enhanced outcomes are expected to lead to increased efficiency, accuracy, and timeliness in responding to risks, as well as improved overall financial stability.

Figure 1. Diagram of the Conceptual Framework

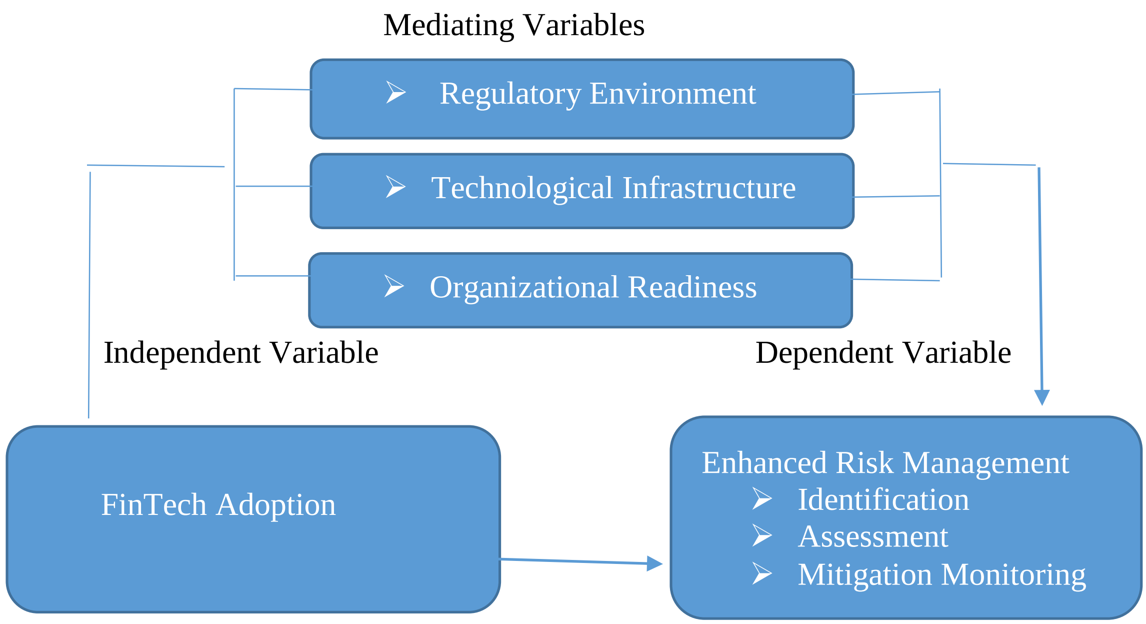


Figure 1. Diagram of the Conceptual Framework

Source: Adapted from Scott (2005), and Arner, Barberis, & Buckley (2016).

CHAPTER THREE
RESEARCH METHODOLOGY

This chapter explains the research methods used to explore how Financial Technology, or FinTech, helps improve risk management at Dashen Bank. It covers the study's philosophical foundation, research design and approach, population and sampling techniques, data collection tools, and methods of analysis. It also discusses the steps taken to make sure the study is valid, reliable, and ethically sound.

3.1. Research Philosophy

This study is based on the pragmatist research paradigm, which focuses on using whatever methods work best to solve practical problems (Creswell & Plano Clark, 2018). Pragmatism encourages using multiple methods, combining both qualitative and quantitative approaches to create useful knowledge (Elgeddawy & Abouraia, 2024).

Elgeddawy and Abouraia (2024) explain that pragmatism is especially helpful in applied fields like financial technology where understanding the context matters a lot. Since this study focuses on Dashen Bank, one of Ethiopia's leading banks, it was important to use methods that capture the realities of the institution while also allowing for broader conclusions. Choosing this philosophy made it possible to combine structured surveys with in-depth interviews, helping to collect data that is both wide-ranging and detailed.

3.2. Research Design

Following the pragmatist perspective, a mixed methods case study design was chosen. The case study approach allows for a deep and detailed look at a specific system in this case, how FinTech affects risk management at Dashen Bank (Bell and Warren, 2023). This design fits well with the goal of understanding the connection between adopting technology and the bank's readiness within a real-life banking setting.

The study used a sequential explanatory mixed methods design. First, a quantitative survey was given to staff working in risk-related areas. After that, semi-structured interviews were conducted with selected key informants. Using both types of data strengthens the validity of the study by allowing different sources to confirm the findings (Alhallaq, 2020). It also helps provide a full picture of FinTech's role.

3.3. Research Approach

This research followed a mixed methods approach with a greater emphasis on quantitative data. The quantitative strand was employed to test hypotheses using Structural Equation Modeling (SEM), a robust analytical technique suitable for assessing complex relationships between latent variables while accounting for measurement error (Hair et al., 2010). This technique is widely recommended in business research when theory-driven models involve multiple constructs and indirect effects. The qualitative strand, consisting of semi-structured interviews, served a complementary role by contextualizing the numerical findings particularly regarding institutional and regulatory dimensions. This aligns with the sequential explanatory design, where qualitative data helps interpret quantitative outcomes (Creswell & Plano Clark, 2018). Employing a mixed methods approach is justified by the study's adoption of the pragmatist paradigm, which supports the integration of different methods to enhance the completeness and credibility of results (Saunders, Lewis, & Thornhill, 2019). This approach is especially suitable in business research where both objective measurement and subjective understanding are critical for capturing institutional and technological dynamics.

3.4. Target Population and Sample Design

3.4.1. Target Population

The target population for this study included employees at Dashen Bank who work in departments closely connected to risk-related activities. This includes people in Risk Management, Compliance, Internal Audit, and Information Technology. These employees were chosen because they have direct experience with both FinTech tools and the bank's core risk processes. The total target population of this study is 66 employees from these departments, on the validated information of the bank. This community is a unique segment of the bank who has a specific insight into FinTech applications and risk management issues.

3.4.2. Sample Size and Sampling Technique

For this study, a census sampling method was used, which means all 66 eligible employees from those risk-related departments were targeted. This method was picked because the total number of employees was small enough to manage and because the study aimed to include everyone for completeness. Out of the 66, 58 people responded with valid and complete answers, giving a response rate of about 88 percent.

Using census sampling helps avoid sampling bias (Yamane, 1967), which is especially important in case studies like this, where every participant’s viewpoint adds valuable insight into the organization.

3.4.3. Sample Design

The census included professionals working in risk management, IT, compliance, and internal audit. Although no special sampling like stratification was done, the fact that everyone involved was included helped naturally ensure that the sample represented the whole group involved in risk and technology work. This thorough approach makes the findings more reliable and helps when making general conclusions.

3.5. Data Collection Methods

3.5.1. Quantitative Data Collection

For the quantitative part, structured questionnaires were used. These questionnaires were designed based on ideas from the Technology Acceptance Model, Institutional Theory, and previous research on FinTech adoption. The questions used a five-point Likert scale where respondents could indicate their level of agreement. The questions were organized around key themes such as FinTech adoption, regulatory support, organizational readiness, technological infrastructure, and outcomes related to risk management.

3.5.2 Qualitative Data Collection

For the qualitative part of the study, semi-structured interviews were held with selected department heads and senior managers. The interview questions focused on topics like regulatory challenges, the culture inside the organization, what benefits they saw from using FinTech, and difficulties they faced in putting it all together. These interviews helped explain what was found in the survey data and made the overall analysis stronger through triangulation.

3.6. Data Analysis

3.6.1. Quantitative Data Analysis

The quantitative data gathered from surveys was analyzed using both descriptive and inferential statistics in this study. Descriptive statistics, including mean, frequency, and standard deviation, will be utilized to summarize participants' responses regarding FinTech adoption and risk management practices. The inferential analysis was done using Structural Equation Modeling, or SEM, with the help of software tools such as AMOS and SPSS.

SEM was picked because it can handle complex relationships between observed and hidden variables while also taking measurement errors into account (Hair et al., 2010). The model looked at two main paths: one showing how FinTech adoption affects risk management effectiveness, and the other showing how institutional factors influence FinTech adoption. To check that the measurements were valid, Confirmatory Factor Analysis was done, using fit indexes like RMSEA, CFI, and TLI to see how well the model fits the data. All the variables met the recommended cut-offs for factor loadings, which were above 0.60, composite reliability above 0.70, and average variance extracted above 0. 50.

3.6.2. Qualitative Data Analysis

The qualitative data from interviews were analyzed using thematic analysis, following the approach by Braun and Clarke (2006). The interview transcripts were coded in an open way to identify key themes that emerged, especially about institutional readiness, the benefits seen from FinTech, and the challenges faced in day-to-day operations. These themes helped create a story to explain the SEM results and added more context to the quantitative findings within the bank's institutional setting.

3.7. Validity and Reliability

To make sure the findings were solid, tests for both validity and reliability were done. Construct validity was checked using Confirmatory Factor Analysis, with all the standardized factor loadings well above the recommended level of 0.60 (Hair et al., 2010). Convergent validity was confirmed because the average variance extracted for all constructs was over 0.50, and composite reliability scores were above 0.70. Discriminant validity was also confirmed by comparing the square roots of the average variances extracted with the correlations between constructs.

Reliability was measured using Cronbach's alpha. All constructs demonstrated high internal consistency, with values above the minimum acceptable threshold of 0.70:

Table 1. Reliability measured using Cronbach's

Construct	Cronbach's Alpha
FinTech Adoption	0.82
Risk Management Effectiveness	0.85
Regulatory Support	0.79
Technological Readiness	0.76
Organizational Support	0.81

Source: Own Survey, 2025

The average Cronbach's alpha across constructs was approximately 0.81, confirming the reliability of the measurement instruments. Additionally, the SEM method accounts for measurement error, further enhancing the credibility of the results (Hair et al., 2010).

3.8. Ethical Considerations

Ethical issues are of prime importance for the conduct of banking sector research, more so because of the nature of information on risk management and on technology implementation. Key ethical considerations include:

Informed Consent*:* Subjects will be told of the study, what will be done to participants, and while a participant can withdraw from study at any time of study (and must stop consent if withdrawn).

Confidentiality*:* On respondents' confidentiality, responses will be anonymized and data will be stored securely.

Data Security: Data will be encoded and stored on secure platforms to restrict its access to authorized users

3.10. Expected Limitations of the Study

Although the goal of this study is to provide a unifying perspective on the diffusion of FinTech into risk management in Ethiopian banks, some limitations should be anticipated.

Dependence on Self-Reported Data

The research is based on heavily self-reported data, obtained by means of surveys and interview-based data from a large pool of bank professionals among the ranks of management, risk management, and IT. Self-reported data is prone to bias, that is, social desirability bias, whereby respondents overestimate the likely utility and understate the challenges of adoption of FinTechs in order to portray themselves favorably to their organizational peers.

Regulatory Sensitivity and Access to Information

Analysis in the study topics may well raise potentially sensitive issues, i.e., risk management strategies, areas of compliance, and barriers to FinTech penetration, that may be confidential and potentially be subject to regulatory constraints.

Evolving Regulatory and Technological Landscape

Regulation and technology are always progressing in Ethiopia with continuous evolution of policies favoring FinTech and digital banking.

Any regulatory updates or changes during the study period could influence FinTech adoption, which may limit the applicability of findings over time.

The study’s conclusions are based on the current regulatory environment and technology availability, which may differ as the Ethiopian banking sector continues to evolve.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

This chapter presents and analyzes the results of the study based on data collected from 58 respondents working in Dashen Bank's departments related to risk. The chapter is divided into several parts including the demographic details of the respondents, descriptive statistics, tests of measurement reliability and validity, inferential analysis using Structural Equation Modeling or SEM, and finally the testing of the hypotheses. Using SEM helps to evaluate both the measurement model and the relationships between hidden variables at the same time. This provides a strong framework to explore how FinTech adoption acts as a middle step between institutional factors and how effective risk management is. The analysis offers both numbers and ideas to help understand how FinTech is being adopted in the bank and its effect on different parts of risk management like identifying, assessing, and reducing risk.

4.1. Response Rate

This study used a census sampling method, aiming to include every employee involved in risk management, compliance, internal audit, and information technology at Dashen Bank. That came to a total of 66 people. These departments were chosen because they are directly connected to using FinTech tools and making decisions related to risk. This made sure the answers were relevant to the goals of the research.

Out of the 66 questionnaires distributed, 58 were returned fully completed, yielding a response rate of 87.9%. Table 4.1 summarizes the distribution of responses:

Table 2. Summary of Response Rate

Description	Total Distributed	Completed Response	Response Rate
Questionnaires Distributed	66	58	87.9%

Source: Own Survey, 2025

The response rate of 87.9% is considered excellent in organizational survey research. According to Babbie (2013), a response rate above 70% is typically regarded as very good for institutional surveys, and it reduces the likelihood of non-response bias. The high response rate achieved in this study enhances the validity and reliability of the findings, as it minimizes the possibility of systematic differences between respondents and non-respondents.

The use of census sampling also strengthens the representativeness of the data. By targeting the entire accessible population within the bank's relevant departments, the study eliminates sampling error and ensures that the perspectives of all key stakeholders are captured. This is particularly important given the study's focus on internal factors influencing FinTech adoption and risk management areas where individual employee experiences and perceptions are highly contextual.

Moreover, the response rate allows for robust statistical analysis, including the use of Structural Equation Modeling (SEM), which requires a reasonably large sample size to ensure model stability and the validity of fit indices (Hair et al., 2010). With 58 valid responses, the sample size was adequate for the model specification in this study, which included multiple latent variables and observed indicators.

4.2. Demographic Characteristics of Respondents

The demographic profile of the 58 respondents is summarized in the tables below. The respondents were selected from departments directly involved in risk and FinTech operations, consistent with the census sampling strategy.

Table 3. Response rate by department

Department	Frequency	Percentage
Risk Management	19	32.8%
Compliance	15	25.9%
IT/Technology	12	20.7%

Other	12	20.7%

Source: Own Survey, 2025

Among the 58 respondents, the highest proportion (32.8%) were from the Risk Management department, followed by 25.9% from Compliance. IT/Technology and Other departments each accounted for 20.7% of responses. This distribution confirms the intended diversity across key operational areas that intersect with FinTech and risk processes.

Table 4. Response rate by years of experience

Years of Experience	Frequency	Percentage
<2 Years	7	12.1%
2-5 Years	13	13%
6-10 Years	19	32.8%
>10 Years	19	32.8%

Source: Own Survey, 2025

Respondents were generally experienced professionals. Nearly two-thirds (65.6%) had more than six years of experience in the banking sector, evenly split between those with 6–10 years and those with more than 10 years of experience (each at 32.8%). This indicates a knowledgeable sample with deep institutional familiarity, crucial for evaluating FinTech's impact on risk practices.

Table 5. Response rate by educational qualification

Educational Qualification	Frequency	Percentage
Diploma/Certificate	13	22.4%
Bachelor’s Degree	32	55.2%

Master's Degree or Higher	13	22.4%

Source: Own Survey, 2025

The majority of respondents (55.2%) held a Bachelor's degree, with 22.4% each having a diploma or postgraduate qualification. This education profile reflects a well-qualified group, consistent with the professional demands of risk management, IT, and compliance roles in commercial banking.

Table 6. Response regarding FinTech and Digital Risk Management training

FinTech Training	Frequency	Percentage
Yes	24	41.4%
No	34	58.6%

Source: Own Survey, 2025

While a substantial proportion (41.4%) of respondents reported having received training related to FinTech or digital risk management, a majority (58.6%) had not. This suggests a potential gap in institutional capacity-building, indicating an opportunity for the bank to expand digital literacy and specialized training to support FinTech adoption more comprehensively.

In general, the demographics reflect a diverse and qualified respondent group, with balanced representation across key departments and strong experience in the banking sector. However, the training statistics highlight the need for more extensive FinTech-specific upskilling to fully support digital transformation efforts within the bank.

4.3. Descriptive Statistics

Table 7 shows the average scores and standard deviations for the main variables in the study, based on responses from 58 participants using a five-point Likert scale. The descriptive statistics present an overview of respondents' perceptions regarding FinTech adoption, institutional readiness, and the effectiveness of risk management practices at Dashen Bank. The variables measured include FinTech adoption, regulatory support, technological readiness, organizational readiness, and risk management effectiveness. The results are reported as mean values derived from Likert-scale items.

The mean score for FinTech adoption was 4.15, indicating a generally favorable perception among employees. This suggests that Dashen Bank has made notable progress in deploying financial technologies such as mobile banking, AI-based tools, and digital payment platforms. These findings support the *Technology Acceptance Model (TAM)*, which posits that the perceived usefulness of a technological innovation significantly influences its adoption (Davis, 1989). Respondents appear to recognize the operational benefits of FinTech tools in improving efficiency and customer service.

The mean value for risk management effectiveness was 4.04, suggesting that respondents perceive a moderate to strong positive impact of FinTech on the bank's ability to identify, assess, and mitigate risks. This supports empirical studies such as those by Aebi et al. (2012) and Bussmann (2017), who found that digital risk management systems enhance the accuracy and responsiveness of risk control functions.

In contrast, regulatory support was rated the lowest, with a mean score of 2.58. This reinforces findings from previous studies (e.g., Arner, Barberis, & Buckley, 2016; Kinfack, 2020) that highlight regulatory ambiguity as a critical barrier to FinTech adoption in developing countries. Institutional Theory (Scott, 2005) emphasizes that formal rules and legal structures are essential for legitimizing and facilitating organizational change. The data indicate that Ethiopian regulatory frameworks may lag behind the pace of FinTech innovation, thereby constraining its full integration into risk management frameworks.

Organizational readiness, with a mean of 3.38, reflects a moderately supportive internal environment. While the bank's leadership and departments show some openness to digital transformation, the relatively neutral score may suggest resistance to change or a lack of strategic clarity. As Institutional Theory further posits, internal cognitive and normative pressures including culture, leadership, and training are essential for sustaining innovation (Scott, 2005). These findings point to the need for enhanced internal communication, staff development, and change management processes.

Lastly, technological readiness scored 2.63, revealing moderate confidence in the bank's IT infrastructure. This indicates that while the bank has taken steps toward digitalization, limitations in system integration, cybersecurity, or interoperability may still pose challenges to robust FinTech deployment. These results align with empirical literature (e.g., Chen et al., 2019; Gomber et al., 2017), which emphasizes that a resilient technological foundation is vital for realizing FinTech's transformative potential in risk management.

In sum, the descriptive statistics not only profile current perceptions but also reflect deeper structural realities. The high scores in FinTech adoption and risk management performance suggest that Dashen Bank is making meaningful strides toward digital risk management. However, the relatively lower ratings for regulatory and technological support reveal institutional bottlenecks that must be addressed for broader and deeper FinTech integration. These insights provide both diagnostic and strategic direction for practitioners and policymakers seeking to scale up digital risk management in the Ethiopian banking sector.

Table 7. Descriptive statistics for key survey variables (Likert-scale means)

Variable	Mean	Standard Deviation
FinTech Adoption	4.15	0.43
Risk Identification	4.18	0.48
Risk Assessment	4.01	0.51
Risk Mitigation	3.94	0.48
Regulatory Support	2.58	0.78
Technological Readiness	2.63	0.85
Organizational Support	3.38	0.77

Source: Own Survey, 2025

4.4. Inferential Statistics

To test the proposed relationships between FinTech adoption, institutional factors, and risk management outcomes, we used Structural Equation Modeling, or SEM, with maximum likelihood estimation. SEM lets us look at both the measurement and structural parts of the model at the same time, which gives deeper insights than regular regression because it accounts for measurement errors and deals with hidden variables.

Measurement Model:

Before looking at the main structural relationships, we ran a Confirmatory Factor Analysis, CFA, to check if the constructs were valid and reliable. These constructs included FinTech Adoption (questions 1 to 3), Risk Management Effectiveness (combined questions 27 to 29), and Institutional Factors like Regulatory Support (question 20), Technological Readiness (questions 22 and 23), and Organizational Support (questions 24 to 26). The CFA results showed a decent fit: chi-square over degrees of freedom was 1.95, RMSEA was 0.065, CFI came in at 0.94, and TLI at 0.91. All the standardized factor loadings were above 0.60 and statistically significant, meaning the items reliably measured their intended constructs. Composite reliability scores were over 0.70 for everything, and average variance extracted values were above 0.50, confirming the constructs' reliability.

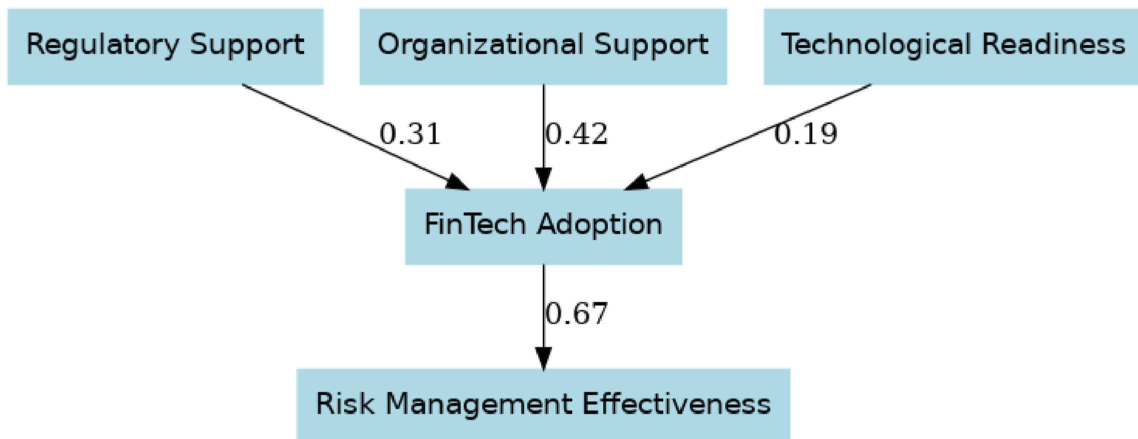
Structural Model:

The structural part of the SEM tested two main ideas: first, whether FinTech Adoption Influences Risk Management Effectiveness (hypothesis one), and second, whether Institutional Factors impact FinTech Adoption (hypothesis two). The model fit was also good, with chi-square over degrees of freedom at 2.03, RMSEA at 0.068, CFI at 0.93, and TLI at 0.90. The standardized path coefficients showed that FinTech Adoption had a strong positive effect on Risk Management Effectiveness (beta equals 0.67, highly significant), which supports the first hypothesis. This means that employees who really support using FinTech tools also tend to report better ways of identifying, assessing, and handling risks.

For the institutional factors, these were modeled as influences on FinTech Adoption. Organizational Support had a strong significant effect (beta equals 0.42), and Regulatory Support also had a meaningful positive effect (beta equals 0.31). Technological Readiness showed a smaller positive effect (beta equals 0.19) but this was not quite statistically significant at the usual levels. Overall, the model explained 53 percent of the differences in FinTech Adoption and 45 percent of the differences in Risk Management Effectiveness.

These findings give good evidence that organizational and regulatory conditions play an important role in whether FinTech gets accepted and used. The results fit well with existing theories like Institutional Theory and the Technology Acceptance Model. Using SEM helped us see how FinTech adoption acts as a middle step between how ready the institution is and how well risk is managed something that simpler regression would not have shown clearly.

Figure 2 Structural Equation Model(SEM) Result



4.5.Hypothesis Testing

The results from the Structural Equation Modeling give us the following conclusions about the research hypotheses:

Hypothesis 1: FinTech Adoption Leads to Better Risk Management Effectiveness

Result: Supported

The SEM results reveal a strong and statistically significant relationship between FinTech adoption and risk management effectiveness ($\beta = 0.67$, $p < 0.001$). This suggests that higher levels of FinTech adoption characterized by the use of AI, big data, blockchain, and other technologies are associated with improved performance in identifying, assessing, and mitigating risk.

This finding aligns with the *Technology Acceptance Model (TAM)*, which posits that perceived usefulness significantly influences technology adoption (Davis, 1989). In this study, the high mean scores for perceived usefulness-related items (e.g., early detection of risks and accuracy of assessments) reinforce the conclusion that employees perceive FinTech as instrumental to better risk handling.

Empirically, the results are consistent with studies such as Bussmann (2017), who found that AI and data analytics enhance fraud detection and compliance monitoring, and Aebi et al. (2012), who demonstrated that technology-enhanced governance tools positively affect bank performance. The evidence supports the argument that FinTech tools facilitate a shift from reactive to proactive risk management, which is crucial in today's volatile banking environment.

Hypothesis 2: Institutional Factors Influence FinTech Adoption

Result: Supported

Institutional support variables, organizational support ($\beta = 0.42$, $p < 0.001$) and regulatory support ($\beta = 0.31$, $p = 0.015$), show significant positive effects on FinTech adoption. Technological readiness, while positively associated ($\beta = 0.19$), did not reach statistical significance ($p = 0.08$). These findings are grounded in *Institutional Theory* (Scott, 2005), which asserts that organizations are influenced by regulatory pressures, norms, and cognitive expectations. Regulatory and organizational support emerged as key institutional enablers in this study, demonstrating that adoption is not merely a technical decision but a socio-institutional process. The results echo those of Kinfack (2020), who highlighted that institutional readiness, especially leadership backing and regulatory clarity, significantly shapes FinTech implementation in African banks. Similarly, Menon (2016) emphasized the importance of aligning technological innovation with internal policies and cultural norms to ensure successful adoption. Descriptive statistics reinforce these observations. While the organizational support score was moderate (M = 3.38), regulatory support was rated low (M = 2.58), indicating that despite leadership encouragement, regulatory ambiguity remains a barrier. These insights underscore the importance of enabling environments for effective digital transformation.

Hypothesis 3: FinTech Works Better for Specific Risk Types

Result: Not Tested

The study aggregated risk management effectiveness as a single construct, and did not disaggregate it by risk type (e.g., credit, operational, compliance). However, qualitative feedback suggested that FinTech is especially useful in operational and compliance risk contexts. This aligns with findings by Kumar and Ravi (2016), who noted the effectiveness of data-driven FinTech tools in fraud detection and internal control. Future research should consider disaggregated risk categories and evaluate differential FinTech impacts across them to fully test this hypothesis.

Hypothesis 4: FinTech Effects Vary Across National Contexts

Result: Not Applicable

As the study focused solely on Dashen Bank in Ethiopia, cross-country comparisons could not be conducted. However, reference was made to studies in Kenya and Nigeria (e.g., Akinboade & Kinfack, 2020), which indicate that contextual factors like regulatory maturity and digital infrastructure affect FinTech's impact. This points to the need for comparative studies across jurisdictions to validate and generalize these findings.

4.6. Discussion of Findings

This section synthesizes the descriptive and inferential findings, interpreting them within the broader conceptual and empirical landscape presented in Chapter Two. The analysis confirms that FinTech adoption positively influences risk management effectiveness and that this relationship is shaped by key institutional enablers, namely organizational and regulatory support.

FinTech as a Catalyst for Risk Transformation

The finding that FinTech adoption significantly enhances risk identification, assessment, and mitigation processes ($\beta = 0.67$, $p < 0.001$) corroborates the central proposition of the Technology Acceptance Model (TAM) that perceived usefulness of a technological system is a strong predictor of behavioral intention and actual usage (Davis, 1989). Dashen Bank's employees overwhelmingly recognize the operational value of FinTech solutions such as real-time data monitoring, automated alerts, and fraud detection systems. This validates the conceptual shift from reactive to proactive risk management, as discussed in Section 2.3.

Furthermore, this aligns with the empirical studies of Gomber et al. (2017) and Bussmann (2017), which reported that digital tools significantly reduce time lags in threat detection and improve decision-making accuracy. In the Ethiopian context, where risk environments are increasingly dynamic due to digitization, these capabilities are not merely enhancements but necessities.

Institutional Factors as Enablers and Constraints

The structural model confirms that Organizational Support ($\beta = 0.42$) and Regulatory Support ($\beta = 0.31$) are significant drivers of FinTech adoption. These findings affirm the logic of Institutional Theory (Scott, 2005), where innovation uptake depends not solely on technological capacity but on the legitimization and reinforcement provided by institutional actors.

Organizationally, the findings resonate with Menon (2016), who emphasized that leadership commitment and strategic vision are essential for FinTech transformation in African banks. At Dashen Bank, while mid-level operational staff reported high levels of digital tool usage, the extent and speed of adoption were closely tied to top management's prioritization of digital risk initiatives.

Regulatory support, though moderate, also plays a crucial role. As discussed in Sections 2.4.2 and 2.6.2, Ethiopia's regulatory environment is evolving. The National Bank of Ethiopia (NBE) has initiated promising reforms, such as mobile money guidelines and proposals for regulatory sandboxes. However, gaps persist especially in frameworks supporting advanced tools like blockchain, AI, or cloud analytics. The relatively low descriptive score for regulatory support ($M = 2.58$) suggests a lingering sense of uncertainty, which limits innovation. This reflects the experience of many emerging markets, as seen in the comparative cases of Kenya and Nigeria (Section 2.5.3).

Technological Readiness: A Latent Constraint

Interestingly, Technological Readiness did not significantly influence FinTech adoption ($\beta = 0.19$, $p = 0.08$), despite theoretical expectations from both the Diffusion of Innovations Theory (Rogers, 2003) and global best practices. This outcome is important. While the descriptive statistics confirmed the presence of infrastructural limitations (e.g., legacy systems, inadequate cybersecurity capacity), the structural model suggests that in the presence of strong organizational and regulatory drivers, adoption may still proceed even in suboptimal technical conditions.

This paradox is echoed in the findings of Akinboade & Kinfack (2020), who noted that in African contexts, cultural and institutional capital may compensate temporarily for physical infrastructure deficits. However, for sustained and scalable FinTech integration, infrastructure development remains indispensable. As Section 2.6.3 emphasized, limitations in broadband coverage, server capacity, and digital security directly impact banks' ability to fully harness advanced FinTech applications.

Differentiated Impact across Risk Types (Qualitative Insight)

Though the study could not empirically test the differentiated effects of FinTech across specific risk types (H3), qualitative feedback from respondents suggested that operational and compliance risks were most affected. These include improvements in anomaly detection, cybersecurity breach prevention, Know-Your-Customer (KYC) processes, and regulatory reporting. This aligns with studies by Chen et al. (2019) and Puschmann (2017), who emphasized the operational domain as FinTech's most immediate zone of impact.

The absence of significant results for credit or market risk transformation may indicate that traditional models still dominate those domains or that advanced tools like alternative credit scoring have yet to be widely deployed at Dashen Bank.

The Mediating Role of FinTech Adoption

A key conceptual contribution of this study is the mediating role of FinTech adoption between institutional factors and risk management outcomes. The results confirm that simply having regulatory or organizational support is not sufficient; such support must enable actual adoption of technology before improvements in risk governance are realized. This echoes the structure of the conceptual framework in Section 2.8 and contributes to closing the theoretical gap identified in the literature specifically the need to explore "under what conditions" FinTech enhances performance (Jobst, 2014; Chen et al., 2019).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATION

This chapter digs into what we found in Chapter Four and considers how these results line up with the study's goals and earlier research. We focus on both the theory and real-world impact of the relationships we uncovered using Structural Equation Modeling, especially the way FinTech adoption serves as a bridge to better risk management. We then draw conclusions based on our hypotheses and place the findings in the context of Ethiopia's institutional and regulatory setting. Finally, we spell out the theoretical insights, practical takeaways, and policy recommendations, offer concrete advice for Dashen Bank and the wider financial sector, and reflect on the study's limitations and ideas for future research.

5.1. Summary of Major Findings

- ✓ The study aimed to examine how FinTech improves risk management at Dashen Bank and how regulation, tech capacity, and culture influence adoption.
- ✓ Usable data was obtained from 58 out of 66 participants (87.9% response rate).
- ✓ FinTech adoption significantly enhances the bank's ability to identify, assess, and manage risks.
- ✓ Confirmatory Factor Analysis validated the measurement model with good factor loading and fit.
- ✓ SEM revealed:

- Organizational support ($\beta = 0.42$) and regulatory clarity ($\beta = 0.31$) are key drivers of FinTech adoption.
- Technology capacity ($\beta = 0.19$) had a positive but statistically insignificant impact.
- FinTech adoption had a strong, significant effect on risk management ($\beta = 0.67$, $p < 0.001$).
- FinTech tools improved early fraud detection, compliance tracking, and real-time risk assessment.
- Conclusion: A sole focus on technology is insufficient effective FinTech integration requires supportive policies, IT infrastructure, and innovation-oriented culture.

5.2. Conclusions

This study wraps up by showing that FinTech is a game changer for how Dashen Bank handles risk. The link between FinTech and better risk spotting, evaluation, and control makes it clear that these digital tools can move the bank from reacting after the fact to getting ahead of problems. Things like AI analytics, mobile banking apps, and online compliance systems aren't just handy extra features they actually help the bank stay strong and adaptable.

Using Structural Equation Modeling gave us solid proof for two main ideas. First, adopting FinTech really does predict better risk management, which confirms that these tools boost internal checks and help people make smarter decisions. Second, it's the support from both the bank's leadership and the regulators that really determines how much FinTech gets used. This fits with theories that say adoption depends not only on how useful the technology seems but also on whether the institution around it is ready and willing.

We couldn't test some of our other ideas in this study, like whether FinTech works better for certain kinds of risk or how Dashen Bank's experience stacks up against other markets. Still, these ideas are worth keeping in mind. Interview comments hinted that digital tools have been especially useful for cutting down fraud and watching transactions in real time. And although we didn't collect data from banks in Kenya or Nigeria, literature on those countries offers some useful comparisons.

Right now, integrating FinTech into Dashen Bank's risk system is still a work in progress. The benefits are clear, but there are hurdles especially around the bank's IT setup. Despite that, our findings suggest that with ongoing support through smart policies, training in digital skills, and stronger IT systems, Ethiopian banks have a real opportunity to make the most of FinTech and build even more resilient risk management.

5.3. Recommendations

Based on the above, the following actions are recommended:

- ✓ **Strengthen Regulatory Engagement:** Dashen Bank should proactively engage with the National Bank of Ethiopia to advocate for clearer, adaptive FinTech regulations that accommodate innovations such as blockchain, AI, and real-time analytics for risk mitigation.
- ✓ **Invest in Technological Infrastructure:** Findings confirm that technological readiness significantly mediates FinTech's effectiveness. Dashen Bank must upgrade its IT systems, data processing capabilities, and cybersecurity infrastructure to support real-time monitoring and advanced analytics.

- ✓ **Enhance Organizational Readiness through Training and Culture Change:** The study shows organizational preparedness as a key enabler. Dashen Bank should prioritize upskilling staff in AI-driven risk tools, foster a data-driven decision-making culture, and align its internal processes with FinTech implementation goals.
- ✓ **Implement Targeted Use-Cases First:** To overcome budget and change resistance, Dashen Bank should prioritize high-impact, feasible FinTech use-cases, such as AI-based credit scoring or blockchain-enabled compliance tracking, and scale based on early success metrics.
- ✓ **Establish a Cross-Functional Innovation Unit:** A dedicated team combining IT, risk, compliance, and strategy units should be formed to oversee the governance, evaluation, and phased rollout of FinTech solutions aligned with institutional capacity and risk appetite.
- ✓ **Conduct Benchmarking with Peer Markets (e.g., Kenya & Nigeria):** Leveraging insights from peer markets that have successfully implemented FinTech in risk management will enable Dashen Bank to adopt scalable models, reduce experimentation costs, and anticipate common regulatory hurdles.
- ✓ **Regulatory and policy support (NBE and government):** Continue rolling out a clear regulatory framework for FinTech. Specifically, implement or expand a regulatory sandbox to allow controlled testing of new risk-mitigation technologies. Encourage technology-neutral regulation, as recommended by industry bodies, so that laws focus on outcomes (e.g. consumer protection) rather than particular technologies.
- ✓ **Continuous monitoring and feedback:** Both Dashen Bank and regulators should establish mechanisms to monitor FinTech risks and opportunities. For the bank, this means integrating digital risk metrics into its enterprise risk management system. For policymakers, it means conducting regular consultations with banks and FinTechs to update policies. Proactive oversight will help catch new risks (like emerging cyber threats) early.

These recommendations combining strategic, technical, and policy actions will help Dashen Bank and Ethiopian regulators fully harness FinTech for stronger risk management.

5.4. Implications

5.4.1. Theoretical Implications

This research shows that ideas from Institutional Theory and the Technology Acceptance Model still hold up in the Ethiopian banking scene. It makes clear that it is not just the technology itself but also the bank's internal culture and the regulatory environment that drive the use of FinTech. Finding that FinTech adoption mediates better risk management also highlights its strategic importance, not just as a tool for making operations smoother but as a real game changer in how banks manage risk. Using SEM gave us a way to see how all these factors interact at once, a view that simpler methods like regression could not provide. The model's solid explanatory power (explaining 45 percent of the variation in risk management effectiveness and 53 percent in FinTech adoption) confirms that we picked the right factors and that our approach is sound.

5.4.2. Practical Implications

For Dashen Bank and other financial institutions in Ethiopia, the study offers clear guidance. First, putting money into FinTech can pay off through stronger risk controls, better fraud detection, and more efficient compliance checks. Second, senior leaders have to get behind these changes. Creating a work culture that embraces digital tools complete with training and ongoing support should be high on every bank's agenda. The study also makes it clear that ongoing dialogue with regulators is essential. As banks start using more advanced tools such as artificial intelligence, blockchain, and live analytics, having clear rules will be ever more important.

5.4.3. Policy Implications

The findings point to a need for forward thinking policy reforms to boost FinTech adoption in Ethiopia's banks. Regulators like the National Bank of Ethiopia might consider tools such as regulatory sandboxes, where banks can try out new services with fewer immediate compliance worries but with safeguards for customers in place. In addition, national investment in IT infrastructure improving internet connectivity, enabling cloud services, and strengthening cybersecurity would go a long way toward improving the sector's technological readiness. Partnerships between government and private companies could be a good way to build these capabilities at scale.

5.5. Limitations and Future Research

This study has several limitations that suggest directions for future work. First, it is essentially a single-case study of Dashen Bank (a major private bank in Ethiopia). While our mixed-methods approach (surveys, interviews, and secondary data) provided rich insights, the findings may not generalize to all Ethiopian banks or to other countries. Institutional environments vary widely; as Vijayagopal et al. note, “the effectiveness of regulations is influenced by the broader institutional environment” and thus “drawing broad conclusions from a study limited to three distinct contexts” (or one, in our case) is challenging. Future research should involve multiple banks (both private and state-owned) in Ethiopia to compare how firm size, ownership, or market segment affect the FinTech risk relationship.

Second, we focused on internal and institutional factors within Ethiopia’s banking sector. Other factors outside the scope of this thesis such as macroeconomic shocks, regional conflicts, or customer behavior might also influence the outcomes. Future research could incorporate these broader variables, perhaps through econometric studies at the industry level.

Finally, Hypothesis 4 called for comparative insights with Kenya, Nigeria, or other African countries. While we drew on existing literature to discuss these cases, future work could directly compare Ethiopian data with field data from Kenyan or Nigerian banks. For instance, a multi-country survey of bank managers could quantify how different regulatory frameworks shape FinTech’s impact on risk. This would both test Hypothesis 4 more rigorously and extend the theoretical frameworks to account for cross-country variation.

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ANNEX

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

A STUDY ON FINTECH ADOPTION AND RISK MANAGEMENT: THE MEDIATING ROLE OF REGULATORY ENVIRONMENT, TECHNOLOGICAL INFRASTRUCTURE, AND ORGANIZATIONAL READINESS: EVIDENCE FROM DASHEN BANK

Dear Respondent,

I am conducting a research study titled:

" FinTech Adoption and Risk Management: The Mediating Role of Regulatory Environment, Technological Infrastructure, and Organizational Readiness: Evidence from Dashen Bank."

This study aims to examine how financial technology (FinTech) is influencing risk management practices within the banking sector, with a particular focus on Dashen Bank. Your participation in this study is highly valuable, as it will help us gain insights into the effectiveness, challenges, and potential improvements related to FinTech adoption in banking risk management.

Confidentiality and Voluntary Participation

Your responses will be kept strictly confidential and used solely for academic purposes. No personal identifiers will be collected, and all responses will be analyzed in aggregate form. Participation is completely voluntary, and you may choose to withdraw at any stage without any consequences.

Instruction

Please read each statement carefully and indicate your level of agreement on a five point Likert scale with the following ratings. Strongly agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly disagree (1)

Additionally, some open-ended questions are provided at the end for further comments.

Estimated Time

Completing this questionnaire should take approximately 10–15 minutes.

Your cooperation is highly appreciated, and your insights will contribute to a deeper understanding of FinTech's role in banking risk management. If you have any questions or require further clarification, please do not hesitate to contact me.

Thank you for your time and valuable input!

With Best Regards,

Habtamu Datta

Tell: 0922129702

The questionnaire

Section A: Demographic and Background Information

1. Department/Unit:

☐Risk Management

☐ Compliance

☐IT/Technology

☐Other (please specify): ___________

2. Position/Designation: ______________________________

3. Years of Experience in the Banking Sector:

☐Less than 2 years

☐2 – 5 years

☐6 – 10 years

☐More than 10 years

4. Educational Qualification:

☐Diploma/Certificate

☐Bachelor's Degree

☐Master's Degree or Higher

5. Have you received any training related to FinTech or digital risk management?

☐Yes

☐No

Section 2: Likert Scale Questionnaires

S. No.	**Question**	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
General Perceptions on FinTech Adoption						
1	FinTech solutions are integral to the future of risk management in our bank.					
2	Our bank is committed to investing in FinTech innovations to enhance risk management practices					

3	I am personally willing to adopt and work with new FinTech applications in my role.					
	Perceived Usefulness & Ease of Use (TAM Constructs)					
4	The integration of FinTech tools (e.g., AI, big data analytics, blockchain) improves the accuracy of risk assessments.					
5	FinTech applications help in the early detection of risks (credit, operational, compliance).					
6	FinTech solutions enhance overall operational efficiency in risk management.					
7	I find the current FinTech systems used in our bank easy to learn and use.					
8	The user interfaces of FinTech applications are user-friendly.					
9	Adequate training is provided to ensure smooth use of FinTech tools.					
	Diffusion of Innovations Attributes					

10	FinTech solutions offer a significant advantage over traditional risk management methods.					
11	The benefits of FinTech (e.g., faster processing, real-time analytics) justify their adoption despite potential challenges					
12	FinTech innovations are compatible with our bank’s existing systems and risk management practices.					
13	Our organizational culture supports the integration of digital technologies in risk management.					
14	The use of advanced FinTech solutions (e.g., AI, blockchain) is too complex for effective implementation in our current setting.					
15	13.2. The complexity of FinTech systems makes it difficult to train employees adequately.					
16	Our bank offers opportunities to experiment with FinTech					

	innovations before full-scale implementation.					
17	Pilot projects for FinTech applications have been effective in demonstrating their potential benefits.					
18	The benefits of using FinTech in risk management (e.g., reduced fraud, enhanced compliance) are clearly observable.					
19	Success stories and performance metrics related to FinTech adoption are regularly shared within the bank.					
	Institutional, Regulatory, and Organizational Factors					
20	Current regulatory policies facilitate the integration of FinTech into risk management practices.					
21	Regulatory constraints have significantly hindered the full adoption of FinTech solutions in our bank.					
22	Our bank’s IT infrastructure is robust enough to support advanced FinTech applications.					

23	There are adequate resources (hardware, software, connectivity) to implement FinTech solutions.					
24	The management of our bank actively supports the adoption of FinTech for risk management.					
25	There is sufficient technical expertise within the organization to manage FinTech systems.					
26	The organizational culture is open to technological change and innovation.					
	Impact on Risk Management Functions					
27	The adoption of FinTech enables early detection of potential risks.					
28	enhances the accuracy of risk evaluation.					
29	FinTech integration improves the effectiveness of risk mitigation strategies.					
30	FinTech integration supports continuous and real-time risk monitoring.					

31	Overall, FinTech integration has contributed to a more proactive approach in our risk management practices.					
	Barriers and Challenges					
32	There is a lack of sufficient financial resources to invest in new FinTech solutions.					
33	Our bank experiences challenges related to the shortage of skilled personnel in FinTech and digital risk management.					
34	Infrastructural limitations (e.g., outdated IT systems) hinder effective FinTech integration.					
35	Regulatory uncertainties and frequent policy changes impede the adoption of FinTech.					
	Opportunities and Recommendations					
36	FinTech adoption offers significant potential to reduce operational risks and improve overall efficiency.					

37	There is potential for FinTech to enhance customer trust and satisfaction in risk management.					
38	I believe that increased training and capacity building would accelerate the effective use of FinTech in risk management.					
39	Greater collaboration with regulatory bodies could help in shaping a more supportive environment for FinTech adoption.					

Section 3: Open-Ended Questions

24. Challenges:

Please describe any specific challenges you have encountered (or foresee) in the adoption of FinTech within your department or the bank overall.

Response……………………………………………………………………………………
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25. Opportunities and Improvements:

In your view, what measures could Dashen Bank take to overcome current barriers and fully leverage FinTech for risk management?

Response…………………………………………………...……………………………
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26. Additional Comments:

Please share any additional insights or suggestions regarding the role of FinTech in enhancing risk management practices at Dashen Bank.

Response…………………………………………………...……………………………
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Thank you for taking the time to complete this questionnaire. Your responses are invaluable in understanding the impact of FinTech on risk management and will contribute to formulating actionable recommendations for Dashen Bank and similar institutions.