Arab American University
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The FinTech Imperative for Banks: Aligning Competitiveness and Performance

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Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is substantially my own work and has not been submitted for any other degree at the Arab American University or any other institution.

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Dedication

I dedicate this dissertation to my family, whose unwavering love and support have been my constant source of strength. To my parents, whose sacrifices and belief in me have shaped who I am today, and to my siblings, whose encouragement and kindness have been a constant throughout this journey.

I also dedicate this work to my mentors and colleagues, whose guidance, insight, and encouragement have played a pivotal role in my academic and personal growth.

Finally, I dedicate this dissertation to all those who inspire curiosity, resilience, and the pursuit of knowledge. This work is a reflection of the collective support and belief in my potential.

Sincerely: Mohammed Nader Abdel- Fattah Turshan

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Abstract

This study investigates the impact of Financial Technology (FinTech) adoption on the banks' competitiveness and financial performance. Utilizing data from all banks operating in Palestine, including listed and unlisted banks registered with the Palestine Monetary Authority (PMA) between 2015 and 2022, the study applies Response Surface Methodology (RSM) to explore the relationship between FinTech adoption and various competitiveness and financial performance indicators related to banks. RSM is particularly suited for modeling and analyzing non-linear relationships, as it employs polynomial regression models to approximate the response surface. This methodology offers a more flexible and precise representation of the underlying interactions between variables, providing significant advantages over traditional linear models in capturing complex patterns.

The independent variable Technological Asset Ratio (TAR), used as a proxy for FinTech adoption, is evaluated against several dependent variables, including the Cost-to-Income Ratio (CIR) and Loan Market Share (LMS) as measures of banks' competitiveness, and Return on Equity (ROE) and Net Interest Margin (NIM) as indicators of banks financial performance. The results indicate that TAR significantly enhances CIR, LMS, and ROE, with p-values below the 0.05 threshold, suggesting a strong positive relationship. However, no statistically significant relationship was found between TAR and NIM, with p-values exceeding 0.05.

Based on these findings, the study recommends that Palestinian banks continue investing in FinTech solutions to enhance operational efficiency and improve loan portfolio management, particularly given the positive impact of increasing technological asset ratios on improving the cost-to-income ratio, the bank's market share of credit facilities, and return on equity. Furthermore, banks should focus on leveraging FinTech in pricing their products and services, considering the lack of impact between the ratio of technological assets and the net interest margin of banks operating in Palestine. The study also recommended that policymakers strengthen regulatory frameworks to support the adoption of FinTech, ensuring a conducive environment for innovation and growth in the banking sector.

Finally, future research should consider comparative and longitudinal studies to assess sector-wide challenges and opportunities related to FinTech adoption. These research approaches could provide deeper insights into the dynamics of FinTech adoption and integration across different contexts, uncovering more nuanced perspectives. Such studies would offer valuable guidance to policymakers, banking executives, and technology developers, helping them address evolving challenges and capitalize on the opportunities presented by FinTech in the banking sector.

Keywords: FinTech, Bank Competitiveness, Bank Financial Performance, RSM.

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List of Definitions of Abbreviations

Abbreviations	Title
ADX	Abu Dhabi Securities Exchange
AI	Artificial Intelligence
AML	Anti-Money Laundering
APM	Alternative Payment Methods
ASE	Amman Stock Exchange
ATM	Automated Teller Machine
CAR	Capital Adequacy Ratio
CIR	Cost-to-Income Ratio
ECM	Error Correction Model
EPS	Earnings per Share
FI	Financial Inclusion
FinTech	Financial Technology
GDP	Gross Domestic Product
ICBC	Industrial and Commercial Bank of China
ICT	Information and Communication Technology
IMF	International Monetary Fund
IoT	Internet of Things
KPI	Key Performance Indicator
KYC	Know Your Customer
LCR	Liquidity Coverage Ratio
MCDM	Multiple Criteria Decision-Making
MENA	Middle East and North Africa
NIM	Net Interest Margin
NPL	Non-Performing Loan
OECD	Organization for Economic Cooperation and Development
OJK	Otoritas Jasa Keuangan
OLS	Ordinary Least Squares
P2P	Peer-to-Peer
PLS-SEM	Partial Least Squares-Structural Equation Modeling
PMA	Palestine Monetary Authority
PRESS	Predicted Residual Error Sum of Squares
R&D	Research and Development
RegTech	Regulatory Technology
ROA	Return on Assets
ROE	Return on Equity
RSM	Response Surface Methodology
SMEs	Small and Medium Enterprises
TAR	Technological Asset Ratio
YEA	Yield on Earning Assets

Chapter 1: Introduction

1.1 Background and Context of the Study

The global trend is currently experiencing a significant transition from a cash-based economy to a non-cash economy, driven largely by advancements in financial technology (FinTech) services. This shift has the potential to transform the financial services sector by providing individuals and businesses with faster, more convenient, and cost-effective options compared to traditional banking channels. FinTech innovations are not merely incremental improvements; they possess the capability to fundamentally alter the structure and dynamics of financial services, resulting in enhanced efficiency and accessibility.

Among the various sectors impacted by technological advancements, the banking industry stands out as one of the most affected. The emergence of digital banking branches, electronic loan approvals, and diverse electronic payment methods exemplify the integration of technology within this field. These innovations facilitate quicker transactions, attract new customers, and significantly enhance the competitive positioning of banks. As a result, financial institutions can improve their operational efficiency and overall financial performance.

The banking industry is fundamental for economic health and stability in all regions of the world, especially in the Middle East and North Africa (MENA) region. Its role in financial intermediation, job creation, infrastructure development, and technological adoption underscores its significance in driving sustainable economic growth and development in the region. As the MENA banking sector continues to evolve, it will be essential to address challenges such as regulatory compliance, competition from FinTech, and the need for digital transformation to ensure its ongoing importance in the regional economy.

FinTech refers to integrating technology into financial services. The term (FinTech) originated with the financial services technology consortium, founded by Citigroup in the early 1990. This concept involves using technology to deliver a wide range of financial services, such as online banking, online payment, transfer services, and cloud-based financial management ***(Schueffel, 2016)***. The rapid advancement of digital technologies and the COVID-19 pandemic have significantly reduced

traditional face-to-face interactions between customers and financial institutions, leading to the widespread adoption of digital networks ***(Feyen et al., 2021)***.

The swift advancement of technology is reshaping the global economic and financial landscape. The Financial Services Authority in Indonesia (**Otoritas Jasa Keuangan: OJK**) defines FinTech as a technological innovation within the financial services industry. The World Bank highlights that FinTech introduces both new opportunities and challenges across the financial sector, impacting consumers, financial institutions, and regulators alike. FinTech services enable transactions to be conducted anytime and anywhere, offering greater flexibility for users ***(Anshari et al., 2019).***

The banking industry faces a rapidly changing environment in requirements and resources. They are also exposed to increasing external threats in addition to internal restrictions that are imposed on them to respond quickly to develop their techniques and strategies and make structural changes to succeed in the modern business environment and ensure sustainability in the long term. The banking industry focuses on strategies that provide more cost-efficient services at the same time to achieve quality from the customer's perspective ***(Soon et al., 2023)***. The world has recently been experiencing a massive technological revolution that has affected everything, including financial institutions in general and the banking industry in particular. Technological innovation in the banking industry has become a global trend for the economies of all developed and developing countries ***(Kirikkaleli & Athari, 2020)***.

The banking industry plays a crucial role in economic cycles, serving as a fundamental pillar of the modern economic system. This importance is due to the essential services and facilities provided by the banking sector ***(Anwar et al., 2020)***. The banking sector has been significantly impacted by technology, with modern advancements leading to various electronic applications in this field. Notably, these developments include the rise of digital branches, electronic loan issuance, and diverse electronic payment methods. These innovations enhance transaction speed, attract new customers, and consequently strengthen banks' competitive positions while improving their financial performance ***(Momaya et al., 2020)***.

Banks in less developed countries reap significant benefits from FinTech adoption, as it allows them to provide more convenient and affordable services, particularly to unbanked and underbanked populations. Conversely, in more developed countries,

FinTech adoption can lead to increased operational costs, suggesting that banks in these regions may not see the same efficiency improvements (***Soon et al., 2023)***.

Various studies indicate that FinTech is significantly reshaping the banking sector by enhancing financial performance, improving customer satisfaction, and fostering greater competitiveness. However, the effects of FinTech vary depending on the region, type of bank, and ownership structure ***(Peter et al., 2018)***. Moreover, it is crucial for regulatory frameworks and risk management systems to evolve alongside FinTech innovations. This evolution will ensure that the benefits of these technologies are fully realized, particularly in areas such as green finance and sustainable development. By adapting to these changes, banks can effectively navigate the challenges and opportunities presented by the FinTech revolution ***(Zhang et al., 2022)***.

In the Palestinian context, the financial and economic indicators of 2023 highlight the relatively large size of the banking sector compared to the Palestinian economy, reflecting the banking sector's depth and its significant relative importance. According to the Palestine Monetary Authority (PMA) data, the Palestinian banking sector has been moving on a clear upward trend, with assets growing by 6.7% to reach $22.8 billion by the end of 2023 compared to the end of 2022, and this represented approximately 154% of the total Gross Domestic Product (GDP) for 2023.

According to (PMA) data, direct facilities (loans) provided by the banking sector reached approximately $12 billion, marking a growth of over 8.5% from the end of 2022, and representing approximately 68.9% of the total Gross Domestic Product (GDP) for 2023. Additionally, total deposits increased by one billion in 2023, bringing the total to $18.4 billion, with a growth rate of 5.7% compared to the end of 2022, and representing approximately 124% of the total Gross Domestic Product (GDP) for 2023.

Given the significance of the Palestinian banking sector and its pivotal role in the national economy, as highlighted by the previous indicators, it is essential to examine how financial technology is influencing this sector and how it is interacting with the ongoing wave of technological innovation.

1.2 Significance and Motivation of the Study

The FinTech revolution signifies a transformative shift in the financial services industry. It disrupts traditional processes and fosters new business models and customer experiences. Institutions that resist adaptation may face obsolescence, while those that embrace FinTech could achieve competitive advantages. The future of financial services will increasingly revolve around technological innovation, with FinTech at the forefront of enhancing efficiency, accessibility, and customer focus ***(Peter et al., 2018)***.

The theoretical significance of this study lies in its contribution to the growing body of literature on the FinTech adoption level and its influence on the traditional banking industry. This research seeks to enhance the understanding of how the FinTech adoption affects both the competitiveness and financial performance of banks, an area where existing theories have yet to fully capture the rapid technological changes in the financial sector. By examining the intersection of technological innovation and banking operations, this study will offer insights into the application of competitive advantage theory in the context of technological disruption. This study will also open pathways for future research to further explore the long-term effects of FinTech adoption on various financial institutions and other sectors impacted by technological advancements.

The theoretical significance of this study is particularly highlighted by its focus on the FinTech adoption within the Palestinian banking industry, a domain where the Palestine Monetary Authority (PMA) has taken proactive steps since 2018 to keep pace with global technological developments. Despite the PMA's significant efforts to promote financial innovation and regulate FinTech solutions, there remains a notable gap in academic research, especially within the MENA region and more specifically in the Palestinian context. This study seeks to address this gap by exploring how FinTech innovations influence both the competitiveness and financial performance of banks in Palestine.

The practical significance of this study is highlighted by the central role of the Palestinian banking sector in the economy and its crucial function in maintaining financial stability in Palestine. By analyzing the impact of FinTech adoption level on

the competitiveness and financial performance of banks operating in Palestine, the study aims to enhance understanding of how technological advancements can improve stakeholder confidence and support the long-term sustainability of banks. This, in turn, contributes to the overall stability of the Palestinian economic environment.

Additionally, from a practical standpoint, the results of this study could assist decision-makers and policymakers in Palestinian banks in formulating effective policies for investing in financial technology. By aligning these policies and investments with the financial performance and competitiveness of banks, they can better support the sector's growth and resilience.

Furthermore, this study has statistical significance because it uses Response Surface Methodology (RSM) in analyzing data, which offers a distinct competitive advantage by allowing for a deeper understanding of complex relationships, optimizing resource allocation, enhancing predictive capabilities, and balancing risk with reward. Banks that adopt strategies based on these RSM findings can make better-informed decisions, improve financial performance, and strengthen their competitive position in a FinTech-driven financial landscape.

1.3 Study Problem Statement

The adoption of FinTech has sparked considerable debate regarding its effects on bank competitiveness and performance. On one hand, FinTech innovations offer banks opportunities to improve operational efficiency, enhance customer experiences, and develop new revenue streams through digital channels and data-driven insights (***Feyen et al., 2021)***. FinTech also introduces advanced technologies, such as artificial intelligence and blockchain, which can streamline processes and reduce transaction costs, theoretically boosting banks' competitive edge ***(Philippon, 2016)***. Other research results indicate that the profitability of traditional banks changes with the presence of FinTech companies in a country and when banks integrate financial technology into their business models. However, statistical analysis reveals that the impact of financial technology on the banking sector's profitability is not statistically significant ***(Abufara &Abu Karsh, 2020)***.

On the other hand, while FinTech presents clear opportunities, it also introduces new risks. The shift towards digital banking increases exposure to cybersecurity threats, such as data breaches, fraud, and hacking, which can undermine consumer trust and lead to significant financial losses ***(Gomber et al., 2018)***. Moreover, the reliance on third-party technology providers may create operational risks, as banks become dependent on external vendors for critical systems ***(Vives, 2019)***. FinTech also challenges regulatory frameworks, as many new technologies evolve faster than existing regulations, leaving gaps in consumer protection and financial stability ***(Zohar, 2018)***. Furthermore, the rise of decentralized financial services, such as peer-to-peer lending and cryptocurrencies, introduces market volatility and the potential for systemic risks that could affect the broader financial system. Therefore, while FinTech adoption presents banks with a pathway to modernization and growth, its risks require careful management and regulation to ensure sustainable competitiveness and stability.

While FinTech offers numerous advantages to the banking sector, such as enhancing efficiency and customer service, it also introduces a range of risks. These include both exacerbating existing risks and creating new ones due to the technological nature of electronic banking services. Despite the potential benefits of FinTech, some research indicates that while it can improve bank financial performance in many countries, these improvements have not always materialized in less developed and developing countries ***(Soon et al., 2023)***.

Since the banking sector in Palestine is a critical component of the economy, it is essential to examine how recent advances in FinTech adoption affect the sector's competitiveness, particularly through efficiency and market share, as well as its financial performance, especially profitability. The rapid evolution of FinTech and its integration into banking practices calls for a thorough analysis of its effects within the Palestinian context. Given the ongoing debate regarding the impacts of FinTech on bank competitiveness and performance, there is a need to:

- Investigate the impact of FinTech adoption level on the competitiveness of banks in Palestine by analyzing how financial technological innovations enhance their operational efficiency and market share.

- Examine the role of FinTech adoption level in improving the financial performance of banks in Palestine, with a focus on key metrics such as profitability.

Addressing these aspects will provide insights into the practical implications of FinTech adoption for the Palestinian banking sector and help identify whether FinTech's benefits are being realized in this specific context.

1.4 Objectives of the Study

This study aims to achieve several key objectives, beginning with illuminating FinTech by providing a comprehensive overview of FinTech and highlighting its significance and role in the modern economic and financial landscape. Moreover, the study's main objectives are:

- Analyzing the relationship between FinTech adoption level and the competitiveness of banks by:
    - Studying the relationship between FinTech adoption, as measured by the Bank Technological Assets Ratio, and competitiveness, as assessed through the Bank Cost to Income Ratio.
    - Studying the relationship between FinTech adoption, as measured by the Bank Technological Assets Ratio, and competitiveness, as assessed through the Bank Loan Market Share.
- Examining the impact of FinTech adoption level on the financial performance of banks by:
    - Studying the relationship between FinTech adoption, as measured by the Bank Technological Assets Ratio, and financial performance, as assessed through the Bank Return on Equity Ratio.
    - Studying the relationship between FinTech adoption, as measured by the Bank Technological Assets Ratio, and financial performance, as assessed through the Bank Net Interest Margin Ratio.

By addressing these objectives, the study will contribute to a deeper understanding of FinTech's impact on the banking industry, particularly in the Palestinian context.

1.5 Questions of the Study

To address the study problem effectively, the researcher will attempt to answer the following questions:

- Does FinTech adoption enhance the competitiveness of banks operating in Palestine? The sub questions of this one are:
    1- Does FinTech adoption, as measured by the Technological Assets Ratio, enhance the competitiveness, as assessed through the Cost to Income Ratio of banks operating in Palestine?
    2- Does FinTech adoption, as measured by the Technological Assets Ratio, enhance the competitiveness, as assessed through the Loan Market Share of banks operating in Palestine?

- Does FinTech adoption improve the financial performance of banks operating in Palestine? The sub questions are:
    1- Does FinTech adoption, as measured by the Technological Assets Ratio, improve the financial performance, as assessed through the Return on Equity Ratio of banks operating in Palestine?
    2- Does FinTech adoption, as measured by the Technological Assets Ratio, improve the financial performance, as assessed through the Net Interest Margin Ratio of banks operating in Palestine?

The answers to these questions aim to provide insights into both the competitiveness and financial performance impacts of FinTech on banks operating in Palestine.

1.6 Hypotheses of the Study

The hypotheses development plays a crucial role in structuring and guiding the research by linking the theoretical framework to empirical investigation. This section outlines the key and sub-hypotheses derived from existing literature and theoretical models that will be tested throughout the study. The development of these hypotheses

is informed by a thorough review of relevant research, allowing for the identification of potential relationships between variables. By clearly stating the anticipated outcomes and their underlying rationale, this section provides a foundation for the research methodology, data analysis, and subsequent discussions. Each hypothesis offers a testable proposition that aims to contribute to a deeper understanding of the research problem and validate or challenge existing theories. In line with the nature of the problem and the objectives and questions of the study, the following hypotheses are proposed:

H_1: FinTech adoption level significantly enhances the competitiveness of banks operating in Palestine.

$H_{1.1}$: Technological assets ratio significantly enhances the Cost-to-Income ratio of banks in Palestine.

$H_{1.2}$: Technological assets ratio significantly enhances the bank's market share from loans of banks in Palestine.

H_2: FinTech adoption level significantly improves the financial performance of banks operating in Palestine.

$H_{2.1}$: Technological assets ratio significantly improves the Return on Equity (ROE) of banks in Palestine.

$H_{2.2}$: Technological assets ratio significantly improves the Net Interest Margin (NIM) of banks in Palestine.

1.7 Limits and Limitations of the Study

This section outlines the conceptual, objective, temporal, spatial, population, and sample limitations and limits of the study. The researcher summarizes these limits as follows:

- Geographic Scope: The study's focus on banks operating in Palestine may limit the generalizability of the findings to banks in other regions with different economic or regulatory environments.
- Time Frame: The study covers a time frame from 2015 to 2022 where the needed data for the study variables are available. It's important to mention that the year

2023 was excluded from the analysis due to the ongoing geopolitical tensions in Palestine. These tensions have significantly impacted economic variables, potentially skewed the results, and made them less reliable.

While the main limitations that are expected to face the researcher relate to the following:

- Data Availability: The availability and quality of data on technological assets and financial technology investments may vary across banks, which could affect the comprehensiveness of the analysis. Moreover, the researcher will have to exclude from the sample banks that experienced losses for two consecutive years and those that did not disclose their digital assets.
- lack of previous studies: One of the primary challenges the researcher encountered was the lack of studies addressing financial technology and its impact on competitiveness and financial performance in Palestine. As this study, to the best of the researcher's knowledge, is the first of its kind in this area, the researcher was prompted to review similar studies from comparable economies to learn the methodology and adapt it to the Palestinian context.

1.8 Conceptual and Procedural Definitions

This section outlined the conceptual definitions that provide a clear understanding of a concept or term based on its theoretical or abstract meaning. These definitions typically explain what a concept is, its characteristics, and its relevance within a particular context. Moreover, the section illustrates the procedural definitions and outlines the specific steps or procedures used to measure, assess, or evaluate a concept. These definitions are often used in research to ensure that a concept is operationalized in a way that can be consistently applied and measured.

- **Artificial Intelligence (AI)** refers to the simulation of human intelligence in machines that are designed to think and learn like humans. These systems can perform tasks such as reasoning, problem-solving, perception, and natural language understanding, which typically require human cognitive functions. AI can be categorized into narrow AI, which is specialized in specific tasks, and general AI,

which can perform a wide range of tasks across different domains ***(Russell & Norvig, 2016).***

- **Blockchain Technology** is a decentralized, distributed ledger system that securely records transactions across multiple computers in a way that the registered transactions cannot be altered retroactively. This technology ensures transparency, enhances security through cryptographic techniques, and enables trustless interactions among participants without the need for a central authority. Blockchain is the foundational technology behind cryptocurrencies, smart contracts, and various applications across industries, including finance, supply chain, and healthcare ***(Tapscott, 2016)***.

- **Competitiveness** refers to the ability of a company, industry, or country to compete successfully in the marketplace, offering goods or services that meet international standards at competitive prices while maintaining or improving market share. It is influenced by factors such as productivity, innovation, cost-efficiency, and the ability to adapt to changing market conditions. Competitiveness can be assessed on both micro (company) and macro (national economy) levels ***(Porter, 1990)***.

- **Cost-to-Income Ratio (CIR)** is a financial metric used to assess a bank's efficiency by comparing its operating expenses to its operating income. A lower CIR indicates greater efficiency, as it signifies that a smaller proportion of income is being used to cover costs (***Ghosh, 2015)***.

- **Financial Performance** refers to the evaluation of a company's ability to generate profits and create value for its shareholders over a specific period. It is typically measured using financial indicators such as revenue growth, profitability, Return on Assets (ROA), Return on Equity (ROE), and Earnings per Share (EPS) ***(Brealey et al., 2019)***.

- **Financial Strength Indicators** refer to quantitative measures used to assess the financial health and stability of an organization, particularly banks. These indicators include metrics such as capital adequacy, asset

quality, management efficiency, earnings stability, and liquidity. They provide insights into a company's ability to meet its obligations and sustain operations over the long term ***(BIS, 2000)***.

- **Financial Technology (FinTech)** refers to using technology to deliver a wide range of financial services, such as online banking, online payment, transfer services, and cloud-based financial management ***(Schueffel, 2016)***.

- **FinTech Adoption level** refers to the integration and utilization of financial technology solutions within existing business models, encompassing various forms of investment. This includes traditional financial institutions implementing new technologies like blockchain, artificial intelligence, and data analytics to enhance their service offerings and operational efficiency ***(Vives, 2019)***. Additionally, it involves the adoption of FinTech platforms for payment processing, lending, wealth management, and other services aimed at improving customer experience and expanding product offerings ***(Arner et al., 2016)***.
- **Gross Domestic Product (GDP) growth Rate** is an economic indicator that measures the percentage increase in the value of all goods and services produced in a country over a specific period, usually annually or quarterly. It is a key indicator of economic performance and health, reflecting the overall economic activity and productivity of a nation ***(IMF, 2021)***.
- **Inflation Rate** the percentage increase in the price level of goods and services in an economy over a specified period, typically measured annually. It reflects the decrease in the purchasing power of a currency, indicating how much more expensive a set of goods and services has become over time ***(OECD, 2020)***.

- **Palestine Monetary Authority (PMA)** is the central bank of the Palestinian territories, responsible for regulating the monetary system, issuing currency, managing foreign exchange reserves, and ensuring financial stability within the region. Established in 1994, the PMA

plays a crucial role in overseeing the banking sector and implementing monetary policy ***(PMA, 2021)***.

- **Peer-to-Peer (P2P) lending** is a form of financial technology that allows individuals to lend money directly to borrowers through online platforms, bypassing traditional financial intermediaries such as banks. These platforms match lenders with borrowers, offering opportunities for individuals or businesses to access loans at potentially lower interest rates while giving lenders the chance to earn higher returns compared to conventional savings accounts or investments ***(Morse, 2015).***

- **Regulatory Technology (RegTech)** refers to the use of innovative technology to help organizations comply with regulatory requirements more efficiently and effectively. It encompasses tools and solutions that automate regulatory processes, monitor compliance in real-time, and manage data related to governance, risk, and compliance. RegTech helps firms reduce the cost and complexity of meeting regulatory obligations by leveraging advancements in artificial intelligence, big data, and blockchain (***Arner et al., 2017)***.

- **Response Surface Methodology (RSM)** is a collection of statistical and mathematical techniques used for modeling and analyzing problems in which a response of interest is influenced by several variables. The goal of RSM is to optimize this response, which is typically affected by multiple input variables, by finding the best combination of input levels. It involves the use of experimental design, regression modeling, and optimization techniques to explore the relationships between input (independent) variables and the response (dependent) variable ***(Montgomery, 2017)***.

- **Robo-advisors** are digital platforms that provide automated, algorithm-driven financial planning services with minimal human supervision. Using advanced algorithms and data inputs, these platforms offer investment management advice, portfolio construction, and rebalancing based on an individual's risk tolerance,

financial goals, and time horizon. Robo-advisors have gained popularity due to their low fees and accessibility compared to traditional financial advisors ***(Fein, 2015)***.

- **Technological Asset Ratio** This metric, defined as the ratio of technological assets to total assets, assesses the importance of technology investments within a company's overall asset structure. A higher ratio indicates a greater dependence on technology to enhance operational efficiency and maintain a competitive edge ***(Melville et al., 2004; Zeng et al., 2010)***.

- **The Association of Banks in Palestine** is a professional organization that represents the banking sector in Palestine. It aims to promote cooperation among banks, advocate for the interests of its members, and support the development of the banking industry in the region. The association plays a key role in addressing regulatory and operational challenges faced by banks ***(ABP, 2021)***.

Chapter 2: Literature Review and Previous Studies

2.1 Introduction

The purpose of this chapter is to provide a comprehensive examination of existing research and theoretical frameworks relevant to the study topic. The literature review serves as a critical foundation for understanding the context and background of the research problem, as well as highlighting gaps in the current body of knowledge. By synthesizing previous findings, this chapter aims to establish the significance of the research questions and the rationale for the study.

This section will begin with an overview of the key themes and concepts that have emerged in the literature surrounding FinTech. This includes a discussion of historical developments, current trends, and emerging issues that have shaped the discourse in this field. For instance, the researcher may explore how FinTech has influenced the evolution of banks' competitiveness and financial performance and the implications of these changes for practitioners and policymakers.

Moreover, the literature review will address both empirical studies and theoretical discussions. The researcher will critically evaluate existing empirical research that investigates the impact of FinTech on banks' competitiveness and financial performance. This evaluation will include a summary of key findings, methodologies used, and the implications of these studies for future research. Moreover, the researcher will highlight any inconsistencies or contradictions in the literature, which may indicate areas where further exploration is needed.

The chapter will also examine the methodologies employed in previous research, providing insights into the strengths and weaknesses of different approaches. This will help justify the methodological choices made in our study, illustrating how the researcher aims to contribute to the ongoing scholarly conversation.

Finally, the chapter will conclude by identifying existing gaps in the literature. These gaps may pertain to specific aspects of FinTech and banks' competitiveness and financial performance that have not been adequately addressed, or they may highlight the need for new research methodologies or theoretical approaches. By articulating

these gaps, the researcher will set the stage for the subsequent chapters of this thesis, demonstrating how our research seeks to fill these voids and contribute meaningfully to the field.

In summary, this literature review will not only provide a detailed overview of the existing research landscape but also establish the groundwork for understanding the relevance and significance of the current study. Through this comprehensive analysis, the researcher aims to underscore the necessity of our research in addressing unanswered questions and advancing knowledge in the field of the FinTech imperative for the banking industry.

2.2 Theoretical Framework

2.2.1 Financial Technology (FinTech)

FinTech has evolved significantly since its early beginnings. In the 1950s and 1960s, the introduction of credit cards and electronic funds transfer systems marked the initial foray into financial technology ***(Narayanan & Iyengar, 2019)***. The 1980s and 1990s saw the rise of personal computers and the internet, leading to online banking and trading platforms. The launch of PayPal in 1998 signified the beginning of digital payments and highlighted the growing importance of technology in financial services ***(Arner et al., 2016)***.

The 2000s and 2010s brought transformative advancements with the proliferation of smartphones, blockchain technology, and cryptocurrencies. Innovations such as peer-to-peer lending and Robo-advisors emerged, reshaping the financial landscape ***(Zetzsche et al., 2020)***. The recent decade has been marked by accelerated digital adoption due to the COVID-19 pandemic, driving further developments in Artificial Intelligence (AI) and Regulatory Technology (RegTech). These advancements continue to enhance user experience, security, and financial inclusion ***(Gai et al., 2018).***

FinTech refers to the integration of technology into offerings by financial services companies to improve their use of financial services. This encompasses a wide range of innovations that streamline and enhance financial operations, including digital payments, online banking, blockchain technology, and automated financial advisory services. FinTech aims to make financial transactions more efficient, accessible, and secure by leveraging technological advancements to meet the evolving needs of consumers and businesses ***(Arner et al., 2016)***.

FinTech encompasses several key components that enhance the efficiency and accessibility of financial services. Digital Payments represent a major aspect, including mobile payment systems, digital wallets, and contactless payment methods, all of which streamline transactions and offer greater convenience to users ***(Arner et al., 2016)***. Another critical component is blockchain and cryptocurrencies. Blockchain technology provides a secure, decentralized ledger for transactions, while cryptocurrencies such as Bitcoin and Ethereum utilize this technology to facilitate

peer-to-peer transactions without intermediaries, thereby disrupting traditional financial models ***(Catalini & Gans, 2016).***

Additionally, Robo-Advisors have become prominent in the FinTech landscape, offering automated financial planning and investment management with minimal human intervention. These platforms use algorithms to deliver personalized advice and manage portfolios efficiently, making financial services more accessible ***(Dorfleitner et al., 2017).*** RegTech is another vital component, focusing on technologies that assist financial institutions in complying with regulatory requirements, including Anti-Money Laundering (AML) and Know Your Customer (KYC) regulations. These technologies help manage regulatory challenges and reduce compliance costs ***(Arner et al., 2016)***.

FinTech has significantly transformed the financial services market by enhancing customer experience, expanding financial inclusion, and increasing competition. Customer experience has improved through innovations such as digital payments, mobile banking apps, and user-friendly investment platforms, which provide more accessible and efficient services ***(Arner et al., 2016)***. These technological advancements have also enabled financial inclusion by offering financial services to underserved and unbanked populations, thereby broadening access to banking and credit ***(Gai et al., 2018)***.

Moreover, FinTech has intensified competition in the financial sector by enabling startups to challenge traditional banks with novel solutions and business models. This competition has driven banks to innovate and adopt new technologies to retain customers and improve service delivery ***(Zetzsche et al., 2020)***. As a result, the financial industry has witnessed significant changes in how financial products and services are delivered, leading to increased efficiency and a more dynamic market environment.

FinTech presents several challenges and risks that impact its development and adoption. Cybersecurity threats are a major concern, as the increasing reliance on digital platforms and data creates vulnerabilities to hacking, fraud, and data breaches. Ensuring robust security measures to protect sensitive financial information is critical to maintaining user trust and regulatory compliance ***(Gai et al., 2018)***. Regulatory

uncertainty also poses a challenge, as the rapidly evolving nature of FinTech often outpaces existing regulatory frameworks. This can result in inconsistent regulations across jurisdictions, complicating compliance for global FinTech companies and potentially stifling innovation ***(Arner et al., 2016)***.

Additionally, Technological complexity and integration issues can hinder the smooth implementation of FinTech solutions. The integration of new technologies with existing systems requires significant technical expertise and can involve substantial costs and time. Moreover, Data privacy concerns arise as FinTech companies handle large volumes of personal and financial data. Ensuring compliance with data protection regulations and addressing user concerns about data privacy is essential for the sustainable growth of FinTech ***(Zetzsche et al., 2020)***.

It can be concluded that FinTech has evolved significantly since its origins in the 1950s and 1960s with credit cards and electronic funds transfers. The 1980s and 1990s introduced online banking and trading, with PayPal's 1998 launch marking the beginning of digital payments. The 2000s and 2010s brought innovations like smartphones, blockchain, cryptocurrencies, peer-to-peer lending, and Robo-advisors. The COVID-19 pandemic further accelerated digital adoption and advancements in AI and RegTech. FinTech aims to enhance efficiency, accessibility, and security in financial services, incorporating key elements like digital payments and RegTech. While it improves customer experience and financial inclusion, challenges such as cybersecurity threats, regulatory uncertainty, and data privacy issues remain.

2.2.2 Financial Technology (FinTech) Measurement Mechanisms

FinTech measurement mechanisms involve a range of metrics designed to assess the performance and impact of FinTech solutions. Key performance metrics, such as transaction volume, user growth, and customer retention rates, indicate user engagement and market penetration ***(Puschmann, 2017; Zavolokina et al., 2016)***. Financial metrics like revenue growth, cost savings, and profit margins reflect the overall health of FinTech services (***Mäntymäki & Salo, 2019; Morrison, 2020)***. User experience is evaluated through the Net Promoter Score, customer feedback, and transaction completion times ***(Reichheld, 2003; Khan et al., 2019)***. Operational efficiency is assessed via processing times, error rates, and scalability (***Zavolokina et***

al., 2016; Bazarbash, 2020). Market impact is gauged through market penetration rates, market share, and competitive positioning ***(KPMG, 2021; Puschmann, 2017)***, while regulatory compliance is measured by adherence to relevant regulations and the effectiveness of risk management practices ***(Zohar, 2018; Basel Committee on Banking Supervision, 2020).***

Additionally, innovation is tracked through R&D investment and time to market, and technological metrics include system uptime and cybersecurity measures (***Mäntymäki & Salo, 2019; Zohar, 2018)***. Collectively, these mechanisms provide a comprehensive framework for understanding the effectiveness and sustainability of FinTech solutions.

When analyzing the impact of FinTech on banks, the Technological Assets Ratio (TAR) can serve as a Key Performance Indicator (KPI) to assess the extent to which traditional banks have adopted FinTech innovations ***(Ozili, 2020)***.

Technological assets refer to any resource or investment a company makes to enhance its technological capabilities. For banks, these assets encompass a variety of elements, including software systems such as core banking software, mobile banking apps, and data management systems. They also include cloud infrastructure like cloud computing and storage solutions, as well as digital platforms that facilitate customer-facing services such as digital banking, payments, and lending. Additionally, IT hardware, such as servers and networking equipment, patents, or proprietary technologies (like blockchain), and Research and Development (R&D) expenditures aimed at innovation and technological advancements, all contribute to the company's technological asset base ***(Kumar & Ayedee, 2021)***.

The **Technological Assets Ratio (TAR)** is calculated as the value of a company's technological assets divided by its total assets, multiplied by 100 as illustrated in the formula:

$$\text{Technological Assets Ratio (TAR)} = \left(\frac{\text{Value of Technological Assets}}{\text{Total Assets}}\right) * 100 \qquad (1)$$

The numerator in this ratio, representing technological assets, includes any items that contribute to the company's digital transformation efforts or IT infrastructure. This broad classification covers expenses and capitalized costs related to enhancing digital

and technological capabilities. Sources for identifying these expenses include regulatory filings like annual reports. In many banks, technological assets are often categorized under "intangible assets" or "capitalized software" on balance sheets. The denominator, total assets, is the value already reported on a bank's balance sheet. It includes all assets the company owns, both tangible and intangible.

The Technological Assets Ratio (TAR) holds significant value in the FinTech context, as higher TAR values indicate that an institution has prioritized technological investments. Such institutions are likely positioning themselves to innovate in customer service delivery through tools like mobile banking, blockchain payments, and automated lending. Additionally, a high TAR reflects efforts to improve operational efficiency by reducing costs through automation and digital workflows. It also suggests a focus on enhancing security and compliance with the use of advanced cybersecurity tools and fraud detection software ***(Gomberet al., 2017)***. Conversely, a low TAR may signal that the institution remains more traditional and could be lagging in adopting new technologies, which poses a competitive risk in an increasingly digital financial landscape ***(Alt & Smits, 2018).***

A key challenge in assessing the Technological Assets Ratio (TAR) is the availability of granular data on technological investments. Many banks do not separately disclose technology-related expenditures, as these costs are often integrated into broader operational expenses. To address this limitation, researchers may need to rely on R&D expenditure as a proxy. If technological assets are not clearly outlined, the total research and development (R&D) expenditures, particularly those related to digital transformation initiatives, can be used as an approximation for technological investment ***(Kane, 2017)***.

In the Palestinian context, banks disclose digital assets as part of intangible assets on their balance sheets, following the instructions of the Palestinian Monetary Authority. This categorization provides a way to track digital transformation investments, although it may require further analysis to separate specific technological investments from broader intangible asset categories. Based on this, the researcher assessed the level of FinTech adoption by calculating the banks' Technological Assets Ratio.

2.2.3 FinTech and Bank Competitiveness

The rise of FinTech has profoundly transformed the financial and banking sectors, resulting in increased profitability, enhanced financial innovation, and improved risk management. By optimizing traditional business models, FinTech reduces operating costs, boosts service efficiency, strengthens risk control, and fosters customer-centric approaches. Collectively, these advancements enhance the competitiveness of financial institutions ***(Momaya, 2019; Panchal & Krishnamoorthy, 2019; Wang et al., 2021)***.

Organizations that strategically adopt FinTech innovations experience positive impacts on their competitiveness and market performance ***(Ahn & Kim, 2019; Wang et al., 2021)***. Key contributors to this heightened competitiveness include advancements in artificial intelligence, mobile technologies, and blockchain, which facilitate superior customer service experiences ***(Momaya et al., 2020)***. Consequently, integrating FinTech innovations has become essential for financial institutions striving to thrive in an increasingly dynamic market landscape.

Several research indicates that FinTech companies disrupt traditional banking models by offering more efficient, customer-centric services. Innovations such as peer-to-peer lending platforms and mobile payment solutions provide viable alternatives to traditional banking products, compelling banks to reassess their service delivery strategies ***(Scholl, 2021).*** As a result, banks are increasingly adopting digital transformation strategies to remain competitive ***(Gomber et al., 2018)***.

The relationship between FinTech and traditional banks is complex and multifaceted. While competition is a significant aspect, many traditional banks are forming strategic partnerships with FinTech firms to leverage their innovative

capabilities ***(KPMG, 2020)***. These collaborations enable banks to integrate cutting-edge technologies while retaining their customer base, ultimately enhancing competitiveness. Research shows that banks engaging in partnerships can innovate more rapidly and offer a broader range of services ***(Pérez & Martínez, 2021)***.

The competitive dynamics within the banking sector have shifted considerably due to the rise of FinTech companies. ***Dash (2017)*** highlights that traditional banks are no longer the sole players in financial services; new entrants are challenging established institutions by providing innovative and agile solutions. This shift necessitates that banks adapt their strategies and embrace collaboration with FinTech firms to maintain their competitive edge.

Furthermore, FinTech has facilitated a shift towards customer-centric business models. ***Wang et al. (2021)*** assert that organizations leveraging FinTech can better tailor their offerings to meet customer needs, thereby enhancing customer satisfaction and loyalty. This focus on personalized services differentiates banks from their competitors and fosters deeper customer relationships, which are crucial for long-term success.

Despite its relatively recent emergence, FinTech has established a significant presence in the global economic landscape, intensifying competition among banks. A study by ***Musa and Alamawi (2020)*** in the UAE emphasizes FinTech's critical role in helping banks gain competitive advantages through electronic services. These innovations enable banks to effectively tackle major global challenges in the electronic banking sector and internal competition.

The research found that the proliferation of information and communications technology has shifted the delivery of financial services from traditional banking institutions to specialized FinTech companies. Consequently, electronic banking has become a priority not only for developed countries but also for developing nations, which are striving to provide electronic banking services and leverage their benefits. This evolution has intensified competition between FinTech firms and banks.

Strategic technological adoption is crucial for enhancing organizational efficiency. When executives actively champion technological innovations, it fosters a cultural shift that drives meaningful outcomes. By adhering to effective strategic management practices, organizations can significantly improve operational efficiency ***Wang et al. (2021)***. This commitment from leadership facilitates the integration of new technologies and cultivates an environment conducive to continuous improvement and innovation.

While FinTech presents numerous opportunities for enhancing bank competitiveness, it also poses challenges. The rapid pace of technological change necessitates that banks continuously evolve and invest in new capabilities. Additionally, concerns related to data security and privacy remain paramount. As noted by ***Panchal and Krishnamoorthy (2019)***, addressing these challenges is essential for banks to sustain their competitive edge in the long term.

Moreover, the rapid growth of FinTech introduces regulatory challenges that affect competitiveness in the banking sector. Regulatory frameworks often lag behind technological advancements, creating a complex environment for both FinTech companies and traditional banks ***(Zetzsche et al., 2020)***. Compliance with regulations can be more burdensome for banks, impacting their agility compared to their nimbler FinTech counterparts.

In conclusion, the relationship between FinTech and bank competitiveness is characterized by disruption, collaboration, and evolving regulatory landscapes. As FinTech continues to innovate, traditional banks must adapt by embracing technology, enhancing customer experiences, and strategically collaborating with FinTech firms. Future research should focus on the long-term implications of these trends for the banking industry and the regulatory frameworks necessary to foster a balanced competitive environment.

From the above, we can conclude that the competitiveness of banks centers around two key aspects. The first aspect involves the efficient execution of operations, which helps reduce costs and enhances the bank’s ability to offer its services and products at more competitive prices compared to other banks in the market. The

second aspect focuses on expanding the bank's market share by leveraging the benefits provided by financial technology.

To address the first aspect (operations efficiency), the researcher will depend on the cost-to-income ratio (CIR) which is a vital metric for assessing the efficiency and competitiveness of financial institutions. It is calculated by dividing operating expenses by operating income as illustrated in the formula, with a lower CIR indicating higher efficiency and better management of costs relative to income. A favorable CIR is often a sign of strong competitive positioning, allowing institutions to offer better pricing, invest in technology, or return greater value to shareholders ***(PricewaterhouseCoopers, 2020)***. In the banking sector, banks that effectively leverage technology to streamline operations typically report lower CIRs, enhancing their competitive edge over traditional financial institutions ***(McKinsey & Company, 2021)***. Furthermore, analyzing the CIR helps financial institutions make strategic decisions regarding cost management and investments in resources, ultimately improving their competitiveness in a rapidly evolving market ***(Deloitte, 2019)***.

$$\text{Cost} - \text{to} - \text{Income}(\text{CIR}) = \left(\frac{\text{Operating Expenses}}{\text{Operating Income}}\right) * 100 \qquad (2)$$

Several studies have established that the cost-to-income ratio (CIR) serves as a crucial indicator of a bank's competitiveness. A low CIR, which indicates higher operational efficiency, has been linked to enhanced competitive positioning, as it suggests better cost management and resource utilization. For instance, ***Garcia and Pradhan (2018)*** analyzed over 200 European banks and found that institutions with lower CIRs not only demonstrated superior profitability but also exhibited greater resilience to market fluctuations. Their study concluded that CIR is a key determinant of long-term growth and competitive advantage in highly competitive financial environments.

Further, ***Alhassan and Asare (2016)*** conducted research within the MENA region, affirming that banks with lower CIRs are more adaptable and responsive to market changes, especially in developing economies where cost efficiency plays a critical role in maintaining competitiveness. The findings suggest that a

low CIR enables banks to offer more competitive products, invest in innovation, and sustain customer loyalty, all of which enhance their market standing.

These studies collectively underscore the importance of CIR as a vital metric for assessing competitiveness, as it reflects how effectively banks' balance operating costs with revenue generation in a rapidly evolving financial landscape.

While addressing the second aspect of competitiveness, particularly in terms of market share, focusing on the bank's market share in loans is crucial. This ratio as illustrated in the formula serves as an important measure of a bank's competitiveness and performance. Banks that can capture a larger share of loans in their market often exhibit higher efficiency in targeting customer needs and leveraging financial technologies to optimize their lending processes. FinTech allows banks to improve their loan offerings by enhancing customer experience through data analytics, reducing non-performing loans, and improving risk assessment. This enables them to grow their loan portfolios, boosting their market share and competitiveness ***(Dai & Vasarhelyi, 2019)***. Additionally, banks with higher loan market shares typically demonstrate better liquidity management and are less exposed to certain financial risks, further enhancing their standing in the industry ***(Davis et al., 2020)***.

$$\text{Bank Market Share (Loans)} = \left(\frac{\text{Bank's Total Loans}}{\text{Total Loans in the Market}}\right) * 100 \qquad (3)$$

To summarize the researcher will address banks' competitiveness through two main ratios, the first ratio is the cost-to-income ratio, which is a key indicator of operational efficiency, representing the percentage of income spent on operating expenses. A lower ratio indicates greater efficiency, as it signifies that a smaller share of income is being allocated to cover costs. This metric is essential for assessing how well a company controls its operating expenses in relation to its revenue. In financial institutions, a decreasing cost-to-income ratio is typically regarded as a favorable sign of financial stability and improved operational efficiency ***(Bourke, 1989)***. The second is bank market share from the loan portfolio.

The second ratio utilized by the researcher to assess bank competitiveness is the bank's market share from the loan portfolio serves as a crucial measure of competitiveness in the banking sector. A higher loan market share indicates that the bank is successfully attracting a larger portion of the lending market, reflecting its strength in offering competitive loan products and meeting customer demand. This ratio is especially important in an environment shaped by financial technology, as the use of data analytics, mobile banking, and other digital tools can significantly enhance a bank's ability to offer tailored lending solutions, thus increasing its market share ***(Davis et al., 2020)***. Banks with a higher loan market share are often better positioned to manage liquidity risk and maintain long-term stability in a competitive market.

2.2.4 FinTech and Bank Performance

The relationship between FinTech and traditional banks is characterized by both collaboration and competition. FinTech companies often collaborate with banks to leverage their established infrastructure and customer base while introducing innovative technologies that enhance financial services. These partnerships allow banks to integrate advanced digital solutions such as blockchain, artificial intelligence, and digital payments into their offerings, thereby improving customer experience and operational efficiency ***(Boehm, 2020)***.

Conversely, FinTech also represents a competitive force to traditional banking institutions. The rise of FinTech startups has introduced new business models and technologies that challenge the conventional banking system. Innovations such as peer-to-peer lending platforms, digital wallets, and Robo-advisors offer alternatives to traditional banking products, often with lower costs and greater convenience ***(Gomber et al., 2018)***. This competition has driven banks to accelerate their digital transformation efforts, adopting new technologies and adapting their services to

remain competitive in an evolving financial landscape ***(McKinsey & Company, 2021)***.

FinTech has become integral to modern banking, transforming various aspects of banking operations and customer interactions. Banks are increasingly adopting FinTech solutions to enhance digital transformation and improve operational efficiency. Digital banking platforms enable banks to offer online and mobile banking services, allowing customers to perform transactions, manage accounts, and access financial services from anywhere. This shift towards digital platforms has significantly improved customer convenience and engagement ***(KPMG, 2021)***.

Another prominent application of FinTech in banking is blockchain technology, which banks use to enhance security, transparency, and efficiency in transactions. Blockchain provides a decentralized ledger that reduces fraud, streamlines cross-border payments, and improves the accuracy of financial transactions. Banks are exploring blockchain for various applications, including smart contracts and trade finance, to streamline processes and reduce costs ***(Arner et al., 2016)***.

Artificial Intelligence (AI) and machine learning are also pivotal in modern banking. Banks leverage AI for risk management**,** fraud detection, and personalized customer service. AI algorithms analyze large volumes of data to detect unusual patterns that may indicate fraudulent activity, while chatbots and virtual assistants powered by AI enhance customer support by providing instant responses and personalized recommendations ***(Deloitte, 2020)***. Additionally, RegTech solutions help banks comply with complex regulatory requirements by automating compliance processes, monitoring transactions for compliance, and managing risk ***(Zetzsche et al., 2020)***.

The integration of FinTech has had a profound impact on bank performance by enhancing efficiency, improving customer satisfaction, and driving innovation. Efficiency gains are significant as FinTech solutions streamline various banking processes. Automation and digital platforms reduce operational costs and transaction times, enabling banks to allocate resources more effectively and improve their bottom line. For instance, robotic process automation and AI-driven tools have been adopted to handle repetitive tasks and customer inquiries, which enhances overall operational efficiency ***(Gomber et al., 2018)***.

Customer satisfaction is notably improved through the use of FinTech. Digital banking platforms, mobile apps, and personalized financial services provide customers with greater convenience and accessibility. By offering a seamless user experience, banks can enhance customer loyalty and attract new clients. FinTech innovations such as chatbots and personalized financial recommendations contribute to higher customer engagement and satisfaction ***(Deloitte, 2020)***. Moreover, innovation driven by FinTech has allowed banks to introduce new financial products and services that meet evolving customer needs, thus strengthening their competitive position in the market. FinTech has led to the development of advanced investment tools, digital wallets, and peer-to-peer lending platforms that diversify and enrich the services banks offer ***(McKinsey & Company, 2021)***.

Additionally, the use of data analytics and predictive modeling facilitated by FinTech has enabled banks to make more informed strategic decisions, manage risks more effectively, and enhance financial forecasting. By leveraging big data, banks can gain insights into customer behavior, market trends, and potential risks, which contributes to better financial performance and strategic planning ***(Arner et al., 2016)***.

Choosing financial performance indicators is one of the most important challenges facing organizations. Performance measurement systems play an essential role in improving strategic plans and achieving organizational goals. These systems are used to make accurate decisions regarding current issues and to plan and forecast the future. According to ***Neal and Al Habsi (2014)***, performance measures must be used carefully to be effective in the evaluation process. Given that banks are profit-driven institutions, their performance is predominantly measured by financial indicators to enhance internal operations, implement the established strategy, and achieve the mission and vision statement. The authors also note that, in the modern world, technological advancements enabling the collection of all types of data have elevated the importance of the quality and suitability of performance measures over their sheer quantity ***(Neal & Al Habsi, 2014).***

The financial performance of a facility provides critical insights into how effectively it utilizes its assets and generates revenue from its operations. Essentially, financial performance gauges the facility's financial health over a specific period, while operational performance is assessed for the same timeframe. Profitability ratios, for

instance, are key metrics used to evaluate an organization's ability to generate profits ***(Zinakova, 2020)***. Financial ratios can be categorized into several types, including profitability, liquidity, activity, and debt ratios, each serving as a valuable indicator of a bank's financial performance. This research will focus on profitability ratios, particularly Return on Equity (ROE) and Net Interest Margin (NIM), as this metric is among the most effective tools for assessing enterprise performance, where the return on equity (ROE) ratio serves as a broad indicator of overall performance, while the net interest margin (NIM) ratio is a more specialized metric used specifically to assess performance in banks ***(Hagel et al., 2013)***.

Based on the above, the researcher relied on two basic measures to measure the financial performance of banks, which are:

- **The Return on Equity (ROE)** which is a key financial metric that measures a company's profitability in relation to shareholders' equity. It indicates how effectively a company uses the money invested by its shareholders to generate profits. ROE is expressed as a percentage and is calculated by dividing net income by shareholders' equity. Multiplied by 100 as illustrated in the formula:

$$\text{Return on Equity (ROE)} = \left(\frac{\text{Net Icome}}{\text{Shareholders' Equity}}\right) * 100 \qquad (4)$$

- **Net Interest Margin (NIM)** which begins by subtracting the interest expenses from the interest income to obtain the net interest income and then dividing this figure by the average interest-earning assets and multiplying the result by 100 to express it as a percentage. This calculation provides a clear representation of the bank's net interest margin as illustrated in the formula:

$$\text{Net Interest Margin (NIM)} = \left(\frac{\text{Interest Income} - \text{Interest Expenses}}{\text{Average Interest} - \text{Earning Assets}}\right) * 100 \qquad (5)$$

Interpreting the result is crucial for understanding the bank's profitability. A higher NIM indicates that the bank is generating more income from its lending activities compared to what it pays out in interest, reflecting strong profitability and operational efficiency. In contrast, a lower NIM may signal potential challenges in managing

interest income or increased funding costs. By regularly calculating the NIM, banks can assess their financial health and operational efficiency, allowing them to make informed decisions regarding their lending strategies and overall performance.

FinTech has emerged as one of the most dynamic and promising sectors globally, owing to its ability to harness modern technological advancements to broaden the scope of financial and banking services. Recent developments in technology have given rise to numerous financial applications and innovative banking solutions. These advancements not only enhance service delivery but also introduce new challenges. Specifically, emerging FinTech companies pose a competitive threat to traditional banks by offering simpler, faster, and more cost-effective services, often without adhering to the stringent regulatory frameworks that govern established financial institutions. As technological innovation accelerates, it frequently surpasses existing regulatory structures, making it difficult to adequately regulate and oversee these rapid advancements ***(Scholl, 2021)***.

2.3 Palestinian Banking Industry

2.3.1 Overview

According to the Palestine Monetary Authority (PMA), By the end of June 2024, the Palestinian banking sector comprises 13 banks: 7 local banks and 6 foreign banks. The foreign banks include 5 from Jordan and 1 from Egypt.

Despite the challenging economic conditions faced by the Palestinian economy, particularly during the last quarter of 2023 and the first half of 2024, the Palestinian banking sector demonstrated amazing resilience. According to PMA by the end of June 2024, the sector's assets had increased by 0.7% compared to the end of 2023, reaching $23 billion. The total value of direct credit facilities extended by Palestinian banks stood at approximately $11.8 billion, reflecting a slight decline of just over 1% since the end of 2023. In contrast, customer deposits in the sector grew by $20 million in the first half of 2024, totaling $17.7 billion, which represents a growth rate of 0.1% compared to the end of 2023.

According to the PMA, the growth of the credit portfolio in the Palestinian banking sector played a crucial role in boosting revenues and profits. By the end of 2023, sector revenues had risen by 17% compared to the end of 2022, reaching $1.03 billion. However, net profits declined by 26% over the same period, totaling $168 million. This decrease was primarily attributed to the provision banks established in response to the challenging political and economic conditions facing Palestine at the end of 2023.

According to data from the Association of Banks in Palestine, the Palestinian banking sector had approximately 385 branches and offices by the end of 2023. The Palestinian banking sector also featured around 737 ATMs. Approximately 7,500 employees worked in the Palestinian banking sector, and the total number of bank accounts reached about 4.42 million. Additionally, approximately 1.85 million bank cards were issued, including 111,000 credit cards.

2.3.2 Performance Trends in the Palestinian Banking Industry

Figure No. (2.1) below illustrates the growth of assets in the Palestinian banking industry from 2019 to the end of June 2024. By the end of June 2024, the assets of the Palestinian banking sector reached approximately $23 billion, reflecting an annual average growth rate of 4.7% during this period. Meanwhile, Figure No (2.2) highlights that credit facilities contributed the largest share of this growth, accounting for 51% of the total assets as of the end of June 2024, foreign assets followed, making up 32%, while the securities portfolio represented just 2% of the sector's total assets.

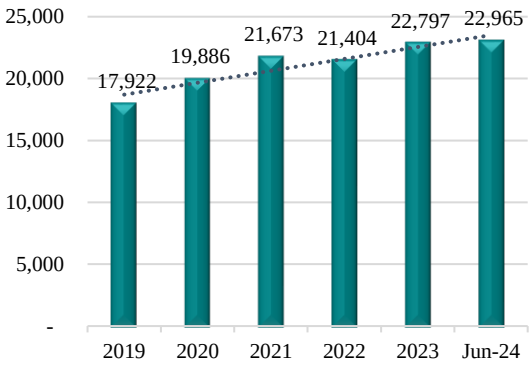

Figure No. (2.1) Palestinian Banking Sector Assets (Million - USD) - *Researcher's Analysis According to PMA Data*

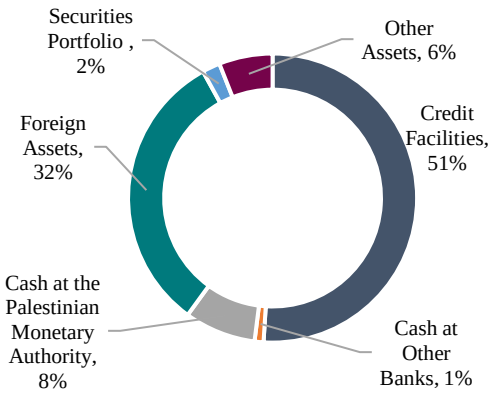

Figure No. (2.2) Distribution of Palestinian Banking Sector Assets - June 2024 - *Researcher's Analysis According to PMA Data*

Figure No. (2.3) indicates a rise in the Palestinian banking industry's liabilities from 2019 to the end of June 2024, with total liabilities reaching approximately $20.6 billion by the end of June 2024. This reflects an average annual growth rate of 4.8% over the period. Customer deposits contributed the largest share, making up 83% of total liabilities. Foreign liabilities accounted for 3%, while local liabilities, including cash balances with the Palestine Monetary Authority and banks operating in Palestine, constituted approximately 6% of the sector's total liabilities as shown in Figure No. (2.4).

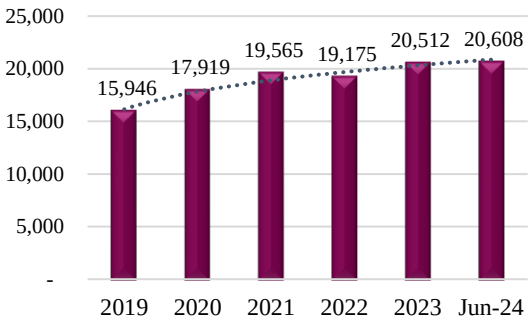

Figure No. (2.3) Palestinian Banking Sector Liabilities (Million - USD) - *Researcher's Analysis According to PMA Data*

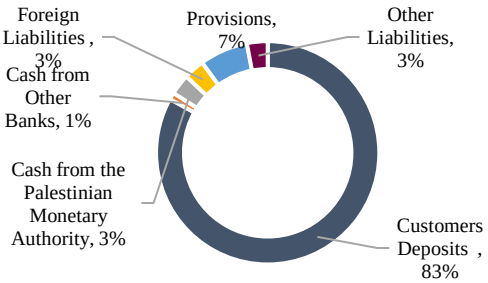

Figure No. (2.4) Distribution of Palestinian Banking Sector Liabilities - June 2024 - *Researcher's Analysis According to PMA Data*

The equity of the Palestinian banking industry grew steadily from 2019 to the end of June 2024, reaching approximately $2.35 billion by June 2024, with an average annual growth rate of 3.2%. Paid-up capital represented the largest portion of this equity, accounting for 55% of total equity, while reserves and provisions made up about 12% during the same period as illustrated in Figure No. (2.5) and Figure No. (2.6).

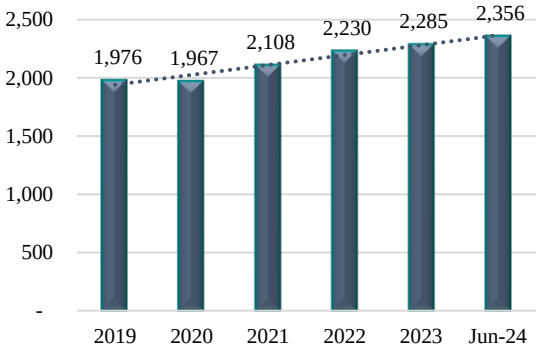

Figure No. (2.5) Palestinian Banking Sector Equity (Million - USD) - *Researcher's Analysis According to PMA Data*

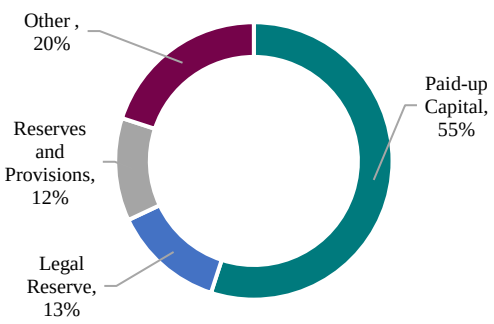

Figure No. (2.6) Distribution of Palestinian Banking Sector Equity - June 2024 - *Researcher's Analysis According to PMA Data*

According to the data from the Association of Banks in Palestine indicate that the revenues of the Palestinian banking sector grew at an average annual rate of 8.3% between 2019 and the end of 2023, reaching approximately $1.03 billion by the end of 2023 as shown in Figure No. (2.7). However, there was a decline of 4.5% in revenues in 2020 compared to 2019, primarily due to the impact of the COVID-19 pandemic. In terms of revenue sources, the same data for 2023 reveals that 80% of the total revenues came from interest income, while commission revenues constituted 10%. Additionally, revenues from foreign currency transactions accounted for approximately 7% of the Palestinian banking sector's total revenue.

Figure No. (2.8) illustrates the expenses of the Palestinian banking sector from 2019 to the end of 2023, showing an average annual growth rate of 10.5%. By the end of 2023, total expenses reached approximately $807 million. There was a significant increase in expenses in 2023 compared to 2022, largely attributed to banks establishing provisions and reserves in response to the challenging economic and political situation in Palestine. Regarding the classification of expenses, according to the Association of Banks in Palestine reveals that staff expenses accounted for 34% of the total expenses of the Palestinian banking sector. This was closely followed by provisions and reserves expenses, which represented 33% of total expenses. Additionally, operating expenses made up approximately 26% of the sector's total expenses during the year 2023.

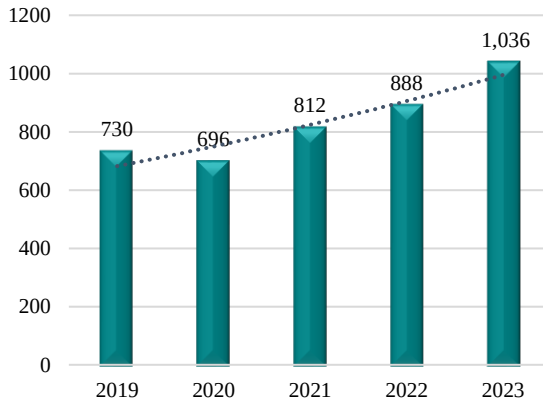

Figure No. (2.7) Palestinian Banking Sector Revenues (Million - USD*) - Researcher's Analysis According to PMA Data*

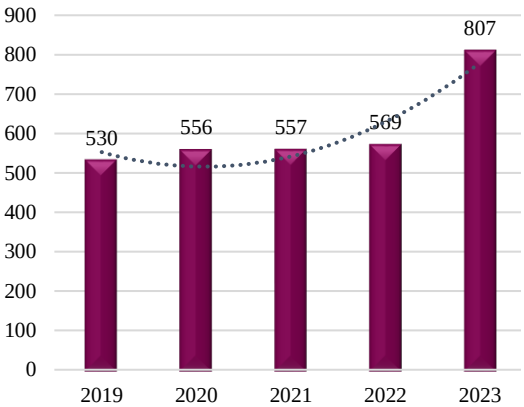

Figure No. (2.8) Palestinian Banking Sector Expenses (Million - USD)- *Researcher's Analysis According to PMA Data*

According to the Association of Banks in Palestine Figure No. (2.9) indicates that earnings before tax for the Palestinian banking sector grew at an average annual rate

of 2.7% from 2019 to the end of 2023, reaching approximately $226 million by the end of 2023. However, earnings before tax saw a decline of 29% in 2023 compared to 2022, largely due to provisions made by banks in response to the difficult economic and political situation in Palestine. Additionally, Figure No. (2.10) indicates that net profits for the Palestinian banking sector grew at an average annual rate of 1.5% over the same period, totaling around $168 million by the end of 2023. Nonetheless, net profits also declined by 26% in 2023 compared to 2022, The decrease is primarily due to banks establishing provisions and reserves in response to the unstable and challenging circumstances in Palestine.

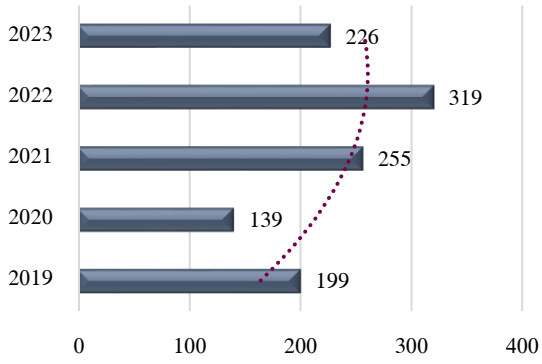

Figure No. (2.9) Palestinian Banking Sector Earnings Before Tax (Million - USD) - *Researcher's Analysis According to PMA Data*

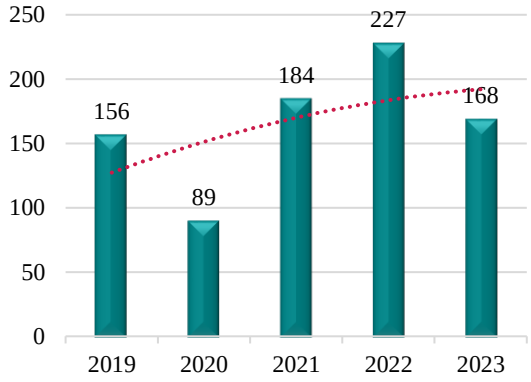

Figure No. (2.10) Palestinian Banking Sector Net Profit (Million - USD) - *Researcher's Analysis According to PMA Data*

At the end of 2023 as shown in Figure No. (2.11) and Figure No. (2.12), the assets and customer deposits in the Palestinian banking sector were distributed similarly. Local commercial banks held 43% of the total assets and 42.6% of customer deposits, while foreign banks accounted for 39.5% of total assets and 39.3% of deposits. Islamic banks held approximately 17.5% of the sector's assets and 18.2% of customer deposits. The credit facilities in the Palestinian banking sector for the same period were distributed as follows: local commercial banks held 49.1% of the total credit facilities, foreign banks accounted for 27.9%, and Islamic banks held approximately 23% as shown in Figure No. (2.13).

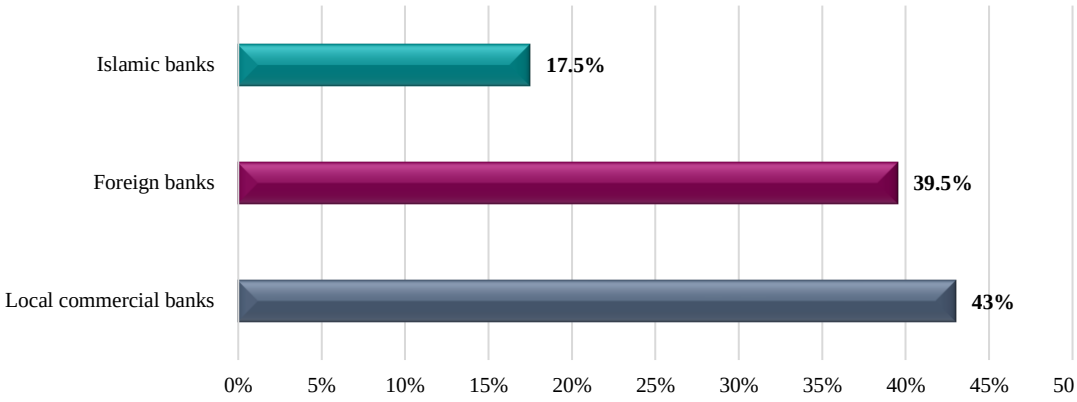

Figure No. (2.11) Distribution of Palestinian Banking Sector Assets Based on Bank Type - *Researcher's Analysis According to PMA Data*

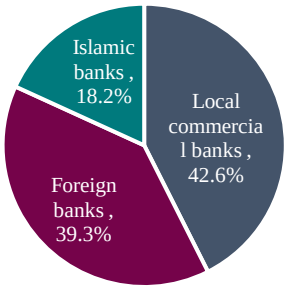

Figure No. (2.12) Distribution of Palestinian Banking Sector Customer Deposits Based on Bank Type - *Researcher's Analysis According to PMA Data*

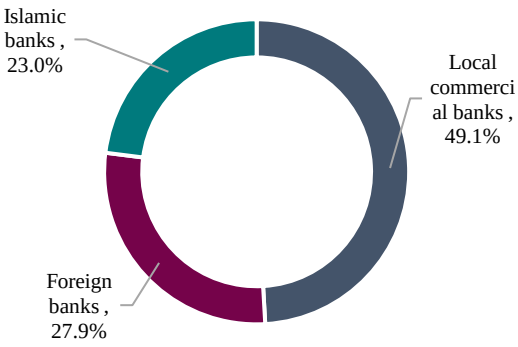

Figure No. (2.13) Distribution of Palestinian Banking Sector Credit Facilities Based on Bank Type -*Researcher's Analysis According to PMA Data*

Figure No. (2.14) and Figure No. (2.15) illustrates the distribution of revenues and net profits in the Palestinian banking sector indicating significant variation between the different banking types. Local commercial banks generated 43.1% of total revenues but accounted for a much larger share of net profits at 67.5%. Foreign banks contributed 41.2% of revenues and 26.9% of net profits. Islamic banks, while contributing 15.8% of the total revenues, held a smaller share of net profits at just 5.6%.

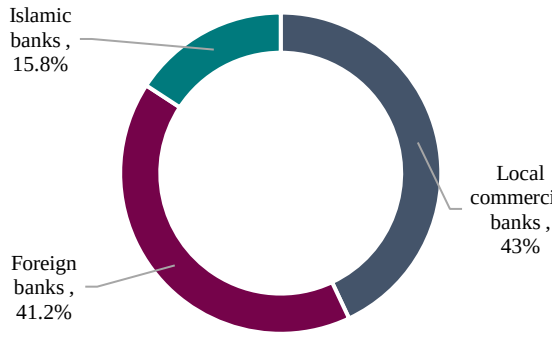

Figure No. (2.14) Distribution of Palestinian Banking Sector Revenue Based on Bank Type - *Researcher's Analysis According to PMA Data*

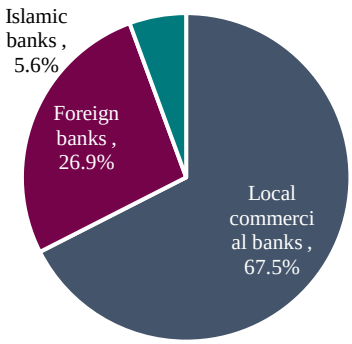

Figure No. (2.15) Distribution of Palestinian Banking Sector Net Profit Based on Bank Type - *Researcher's Analysis According to PMA Data*

Figure No. (2.16) illustrates the ranking of banks operating in Palestine based on their classification in terms of net interest and commission income or (financing and investment net income: Islamic bank) as a percentage of total revenue at the end of 2023. Islamic banks ranked first, with 90.3% of their revenues derived from financing and investment net income in Islamic banks or net interest and commission income in traditional banks, followed by local commercial banks at 86.4%, and foreign banks in third place at 85.6%. Notably, the overall percentage of net interest and commission income to total revenue for the entire Palestinian banking sector stood at 89.4% by the end of 2023.

Figure No. (2.17) and Figure No. (2.18) illustrates the performance of banks operating in Palestine at the end of 2023, focusing on their return on assets (ROA) and return on equity (ROE). In terms of ROA, foreign banks led with a rate of 1.02%, followed by local commercial banks at 0.61%, and Islamic banks in third place at 0.14%. The overall return on assets for the Palestinian banking sector was 0.8%. For ROE, foreign banks again ranked first with 8.56%, while local commercial banks followed with 5.51%. Islamic banks ranked third with an ROE of 1.88%. The overall return on equity for the Palestinian banking sector reached 7.9%. It's important to highlight that foreign banks achieve higher rates of return compared to local banks. This difference can be attributed to the conservative lending policies adopted by foreign banks, particularly in the Gaza Strip, where geopolitical tensions prevail. As a result, these cautious practices have led to a lower rate of non-performing loans, subsequently boosting the overall rates of return.

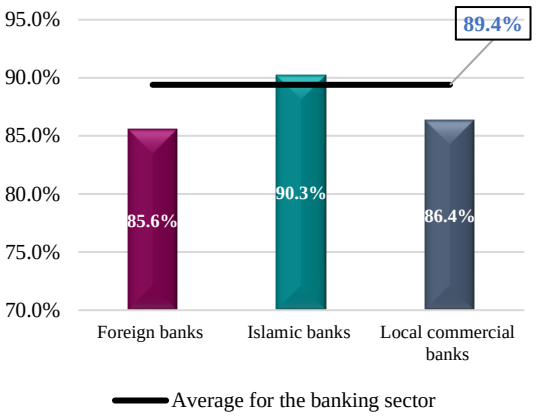

Figure No. (2.16) Palestinian Banking Sector Net Interest and Commission Income / Revenue Based on Bank Type - *Researcher's Analysis According to PMA Data*

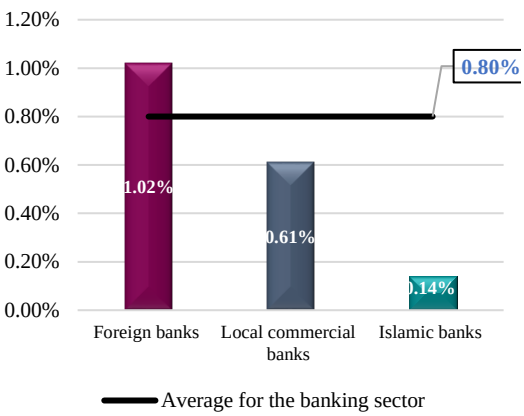

Figure No. (2.17) Palestinian Banking Sector ROA Based on Bank Type - *Researcher's Analysis According to PMA Data*

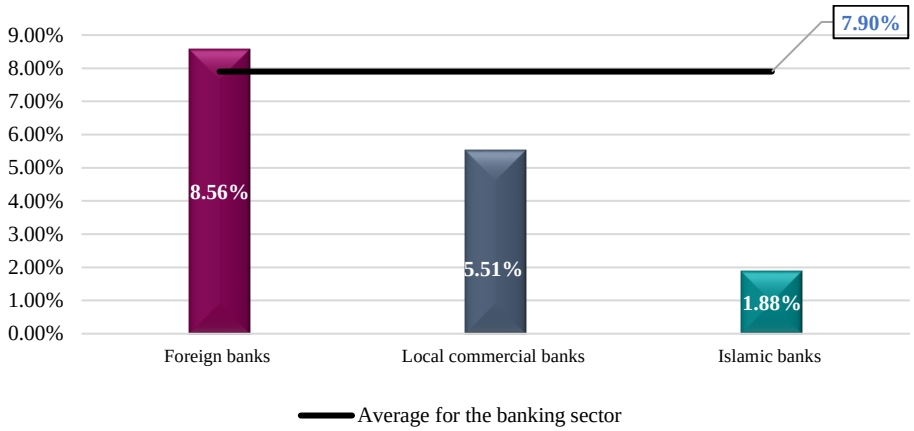

Figure No. (2.18) Palestinian Banking Sector ROE Based on Bank Type - *Researcher's Analysis According to PMA Data*

2.3.3 Financial Strength Indicators of the Palestinian Banking Sector

The financial strength of the Palestinian banking sector is critical for its stability, growth, and ability to withstand economic challenges. Several key indicators are used to assess the financial health of banks in this sector. These indicators provide insights into various aspects of banking performance, including profitability, liquidity, asset quality, and capital adequacy. Table No. (2.1) below illustrates some of the most significant financial strength indicators relevant to the Palestinian banking sector:

Table No. (2.1): Financial Strength Indicators of the Palestinian Banking Sector[1]

Ratio Category	Ratio Name	Ratio Amount	Clarification
Capital Indicators	Regulatory capital to risk weighted assets (Capital adequacy-CAR)	16.2%	The capital adequacy ratio is a crucial indicator of a bank's financial stability, assessing its ability to cover risk-weighted assets with its available capital. In 2023, this ratio experienced a slight decline, dropping to approximately 16.2%, compared to around 16.3% in 2022.
	Non-performing loans (NPLs, net of loans loss provisions) to capital	- 5.7%	This ratio evaluates how well a bank's capital can absorb potential losses from non-performing loans or the extent to which non-performing loans (after accounting for loan loss provisions) could impact capital. A lower value signifies stronger capacity to handle expected losses. In this regard, financial stability indicators show that the ratio of net non-performing loans to core capital decreased to -5.7% in 2023, down from 1.1% in 2022.
	Core capital to gross assets	8.2%	This ratio reflects the degree of financial leverage, indicating how much of a bank's assets are financed by means other than its own capital. It also illustrates the extent to which core capital supports the bank's total assets. In 2023, this percentage saw a slight decrease, dropping to approximately 8.2%, compared to 8.4% in the prior year.
Asset quality Indicators	Non-performing loans-to-total gross loans	4.5%	The ratio of non-performing loans to total loans is a key lagging indicator of asset quality, as financial insolvency risks are closely tied to the quality of a bank's assets. This ratio also highlights the bank's ability to convert assets into liquidity. In 2023, non-performing loans grew by approximately 13.5% compared to 2022, reaching USD 538.1 million, which raised their share of total credit to 4.5%, up from 4.3% the previous year.
	Loans-to-total assets	52.6%	This ratio illustrates the extent of banks' exposure to lending and financing risks, as well as their capacity to manage and mitigate these risks. By the end of 2023, the banking sector's credit portfolio had grown to approximately 12.0 billion dollars, marking an 8.5% increase from the previous year. This represented 52.6% of the sector's total assets, up from 51.6% in 2022.
	Sectoral distribution of total loans	19.1% For Real Estate Sector	This ratio measures the level of concentration/diversification in the credit portfolio across sectors and economic activities, based on its compliance with the Palestine Monetary Authority's Instruction No. 4/2022, which aims to limit the risks associated with credit concentrations and exposures at banks. According to these regulations, a bank is prohibited from exceeding 20% of its total credit facilities within a particular economic sector without obtaining

[1] PMA Annual Report 2023.

Ratio Category	Ratio Name	Ratio Amount	Clarification
			prior approval from the Monetary Authority. The data indicates that the credit portfolio for various sectors and economic activities is in compliance with the Monetary Authority's instructions. The real estate and construction sector held the largest share, accounting for 19.1% of total credit facilities granted in 2023.
Earning and profitability indicators	Return on assets (ROA)	1.2%	This ratio reflects the efficiency of a bank in utilizing its assets (the effectiveness of its credit-granting process) and its ability to maintain and grow them by generating suitable returns. This, in turn, enhances investment inflows to the banking sector and boosts confidence in its stability. In line with the decline in bank income, the return on assets (ROA) for the banking sector dropped to approximately 1.2%, compared to 1.5% in 2022.
	Return on equity (ROE)	7.6%	This ratio reflects the efficiency in capital utilization, which saw a decline in 2023, reaching 7.6%, compared to 11% in 2022. This drop was influenced by the faster decrease in net income within the banking sector compared to the growth in capital.
	Net interest income-to-gross income	80.9%	This ratio is one of the most important measures of a bank's operational efficiency, as it reflects the bank's ability to generate income from its core activities (financial intermediation). It also serves as a gauge of the relative importance of net interest income (interest received minus interest paid) to the total income generated from all operations. In this context, the data indicates an increase in interest income across the banking sector in 2023, leading to a rise in the contribution of net interest income to total income from 75.2% in 2022 to 80.9% in 2023.
	Non-interest expenses-to-gross income (operational efficiency)	51.8%	This ratio measures the relative significance of non-interest expenses to total income, including wages and salaries, property and equipment costs, non-banking commissions, deposit insurance, and other administrative expenses that contribute to profitability. It reflects the bank's efficiency in utilizing its resources, with a lower ratio positively impacting profitability indicators. In 2023, non-interest expenses as a percentage of total income decreased to 51.8%, down from 57.1% in 2022.
Liquidity indicators	Liquid assets-to-total assets	31.2%	The ratio of liquid assets to total assets is one of the key metrics that measures a bank's ability to meet its obligations using high-quality, liquid assets that can be converted to cash more quickly than other assets. This ratio reflects the bank's capacity to withstand shocks to its balance sheet, based on the level of liquidity available to address both anticipated and unforeseen cash demands. In 2023, the ratio of liquid assets to total assets for banks experienced a slight decline, reaching approximately 31.2%, compared to 32.6% in 2022.
	Liquid assets-to-short-term liabilities	43.1%	This ratio indicates the alignment of maturities between banks' short-term liabilities and their liquid assets, ensuring that they can meet these obligations without encountering liquidity crises or losses. Data shows that this ratio declined in 2023 to 43.1%, down from 44.1% in 2022.
	Liquidity Coverage Ratio (LCR)	297.7%	This ratio measures the value of high-quality liquid assets that a bank holds to meet cash outflows over a period of up to thirty days, aimed at enhancing the banks' resilience against potential liquidity disruptions within that timeframe. This ratio should not fall below 100%, meaning that high-quality

Ratio Category	Ratio Name	Ratio Amount	Clarification
			liquid assets must at least equal net cash outflows. By the end of 2023, this ratio for the banking sector stood at approximately 297.7%, indicating that high-quality liquid assets cover more than double the net cash outflows.
	Net Stable Funding	176%	This ratio measures the value of long-term funding sources (over one year), including capital and liabilities that are expected to represent reliable funding sources for the bank, in relation to investments in assets and the likelihood of ongoing financing claims arising from external liabilities that are anticipated to be funded continuously over a year. The aim of this ratio is to assist banks in structuring their funding sources and contingent liabilities by maintaining stable liabilities to finance their illiquid assets. By the end of 2023, this ratio reached 176%.

In conclusion, capital indicators reflect the overall strength of a bank's capital and its ability to absorb shocks and potential losses from various risks, including credit, operational, market, liquidity, and reputation risks. As demonstrated in the table above, these indicators suggest a positive outlook for the Palestinian banking sector. The implementation of sound regulations, controls, and adherence to international lending standards has allowed banks to expand their credit portfolios while maintaining low risk levels, which has helped preserve asset quality at satisfactory levels despite the challenges and risks faced by the Palestinian economy. Additionally, liquidity indicators, which reflect the adequacy of liquid assets for meeting obligations without incurring losses, were also favorable for the Palestinian banking sector.

2.3.4 FinTech and Innovation in Palestine

In recent years, Palestine has experienced rapid growth in financial technology, spurred by the emergence of startups that support financial institutions and digital solutions. This development aims to enhance the efficiency of financial service providers, promote economic prosperity and inclusion, and improve service quality while reducing costs and enhancing customer experience.

The PMA has responded to this trend by launching initiatives to support the FinTech sector and digital transformation in Palestine. This includes establishing the Financial Technology and Creativity Department to implement strategies and monitor market developments, alongside an advisory team comprising specialists and representatives from business incubators.

Additionally, the PMA is fostering cooperation with regional and international organizations to adopt best practices in the banking sector. To foster innovative financial technology solutions in Palestine, the PMA is establishing a Regulatory Sandbox. This controlled environment will allow licensed financial institutions, startups, and individuals to test their FinTech solutions while ensuring compliance with laws protecting users, confidentiality, and anti-money laundering measures. Participants will receive support and guidance from the PMA, which may adjust regulations to accommodate innovations that enhance financial inclusion, consumer protection, and economic growth.

The Regulatory Sandbox aims to create a secure environment for testing innovative financial technology solutions with real customers. It provides a supportive framework that helps overcome legislative obstacles, attracting both local and international FinTech providers to introduce new financial products in Palestine. The initiative facilitates the implementation of technologies that enhance digital financial services, offers guidance to improve the quality and safety of FinTech products, and helps the PMA adapt to rapid technological changes. Additionally, it promotes connections between innovative initiatives and investment funds for startups.

The scope of application in the Regulatory Sandbox encompasses all financial technology products and services in the financial sector that are fully developed and meet specific eligibility criteria outlined in the framework. This ensures that only compliant innovations are tested within the sandbox environment.

2.4 Review of Related Previous Studies

This section provides a critical examination of existing literature and studies related to the impact of financial technology (FinTech) on the banking sector, with a particular focus on Islamic and conventional banks. The review aims to highlight key findings, methodologies, and theoretical frameworks that have shaped the current understanding of the interplay between FinTech innovations and banking performance. This section is divided into two axes: the first is related to foreign studies, and the second is related to local and Arab studies.

2.4.1 Foreign Previous Studies

- **Harvard Business Review Report (2024), "The Impact of Digital Finance on Banking: A 2024 Review".**

  The article examines the significant influence of digital finance innovations, particularly FinTech, on the competitiveness and performance of U.S. banks. It draws insights from a diverse range of banks, including large national institutions and smaller regional players, incorporating data and case studies from various banking sectors. This approach illustrates how different institutions are responding to the challenges posed by FinTech innovations.

  The review employs a qualitative methodology, synthesizing information from recent studies, industry reports, and expert interviews to assess the impact of digital finance on banking. By analyzing trends in consumer behavior, technological advancements, and the competitive landscape, the article provides a comprehensive overview of how banks are navigating this evolving environment. Specific case studies highlight banks that have successfully adapted to the challenges posed by digital finance.

  The report further included interviews with various stakeholders within banks to gain a deeper understanding of their perspectives on the influence of financial technology on competitiveness and performance. These qualitative insights enriched the analysis by highlighting the specific ways in which FinTech innovations are reshaping operational strategies, customer engagement, and overall market positioning in the banking sector.

The findings reveal that banks are increasingly transforming their business models to integrate digital finance solutions, adopting technologies such as mobile banking apps, artificial intelligence, and blockchain. Additionally, FinTech startups are exerting significant competitive pressure on traditional banks, prompting innovations in service delivery and customer engagement. This has led many banks to invest in technology to improve operational efficiency and enhance customer experiences. The review also highlights a shift toward a more customer-centric approach in banking, driven by the demand for personalized services and seamless digital interactions.

To address these challenges, the article offers several recommendations. First, banks are encouraged to fully embrace digital transformation by investing in new technologies and platforms that enhance their service offerings. Collaboration with FinTech companies is also recommended, as such partnerships can leverage innovative solutions and accelerate banks' digital initiatives. Furthermore, banks should prioritize improving customer experience through data analytics and personalized marketing strategies. Lastly, the review calls for a re-evaluation of regulatory frameworks to support innovation while ensuring consumer protection and financial stability.

- **Soon *et al.* (2023), "Differential Impact of FinTech and GDP on Bank Performance: Global Evidence".**

  The study explores the global impact of FinTech on bank performance, with a focus on how this impact varies depending on countries' GDP per capita. Using data from 91 countries in 2014, 2017, and 2021, drawn from the World Bank’s Global Findex Database, the study applies multiple regression analysis to understand how FinTech development influences key bank performance indicators like Return on Assets (ROA), Net Interest Margin (NIM), and the cost-to-income ratio. The authors introduced a novel measure, "abnormal FinTech" (AbFinTech), to control for the high correlation between GDPs per capita and FinTech levels. This allowed them to isolate FinTech's impact on bank performance across different income groups.

The study highlights several key findings on FinTech's impact. First, FinTech adoption has a significantly positive effect on bank performance in less developed countries, improving return on assets (ROA) and net interest margins (NIM), particularly in nations with lower GDP per capita. In the least developed countries, FinTech notably boosts ROA, while enhancing NIM in countries at the 75^{th} GDP percentile. Second, FinTech adoption improves efficiency by reducing the cost-to-income ratio in less developed nations, but increases this ratio in developed countries, indicating higher costs relative to income. Lastly, the study finds no significant relationship between FinTech, and the income mix ratio (non-interest income to total income) across countries.

The study indicates that banks in less developed countries benefit the most from FinTech investments, as FinTech enables them to offer more convenient and cost-effective services, especially to unbanked or underbanked populations. In contrast, FinTech adoption in more developed countries tends to increase operational costs, suggesting that banks in these regions may not experience the same efficiency gains. The research concludes by highlighting the differential effects of FinTech based on a country's economic development, advocating for tailored FinTech strategies that address the specific needs and conditions of banking sectors in various regions.

- **Jiang *et al.* (2023), "The Impact of FinTech on the Performance of Commercial Banks: Evidence from China".**

The study examined the theoretical foundations of how financial technology (FinTech) affects the performance of commercial banks. The research utilized sample data from 37 listed commercial banks over a period from 2011 to 2020. By employing text mining methods, the study constructed a FinTech index and utilized a multiple regression model for panel data analysis.

The findings indicated that FinTech has a significant positive impact on the performance of commercial banks. Based on the actual evolution of FinTech within these banks, the study concludes with effective policy recommendations to enhance the integration and application of FinTech solutions in the banking sector.

- **Zhang *et al.* (2022), "FinTech Innovation and Green Growth: Evidence from China".**

  The study aims to investigate the impact of FinTech innovation on green economic growth in China. It explores the mechanisms through which FinTech influences green finance, specifically focusing on green credit and green investment. Additionally, the research examines regional heterogeneity in these effects across different provinces.

  To achieve its objectives, the research employs panel regression analysis using three estimation strategies: mixed regression, fixed effect, and random effect models. Among these approaches, the fixed effect model is determined to be the most suitable for analyzing the data. The study tests several hypotheses regarding the contribution of FinTech innovation to green growth and its regional variations. Furthermore, it constructs a green growth index based on a three-level indicator system and utilizes dynamic factor analysis for evaluation.

  The sample consists of provincial panel data from 31 provinces in China, covering the years 2011 to 2018. The research focuses on the relationship between FinTech innovation and green growth, paying particular attention to differences in impact across the eastern, central, and western regions of China.

  The findings indicate several key points. Firstly, FinTech innovation significantly promotes green economic growth, with a more pronounced impact observed in the eastern region compared to the central and western regions. Secondly, the mechanisms through which FinTech innovation affects green growth primarily involve improvements in green credit and green investment. Finally, the study confirms the existence of regional heterogeneity, revealing that the eastern region benefits more from FinTech innovations due to its higher economic development level.

  Based on these findings, the authors provide several recommendations. They suggest enhancing support for green growth initiatives across all regions, with a focus on the systematic and synergistic development of FinTech. Additionally, there should be active promotion of FinTech innovations to facilitate green growth. Strengthening supervision of FinTech innovations is also essential to mitigate potential risks while

fostering their development. Lastly, the authors encourage future research to explore additional dimensions of green finance to gain a deeper understanding of the complex relationships between FinTech innovation and green growth. This comprehensive approach aims to inform policymakers and stakeholders about the critical role of FinTech in advancing sustainable economic practices in China.

- **Zhao *et al.* (2022), "The Impact of Financial Technology Innovation on the Performance of Chinese Banks".**

  The study examined the impact of financial technology (FinTech) innovation on the performance of Chinese banks, using patent data and the FinTech development index. The researchers employed a generalized method of moments model to address potential endogeneity issues. The findings indicate that, overall, FinTech innovation negatively affects banks' profitability and asset quality, with larger state-owned commercial banks experiencing a more significant decline. Conversely, FinTech innovation improves banks' capital adequacy and management efficiency, although this effect is less pronounced for policy banks and state-owned banks. The study also highlights that banks' specific FinTech capabilities, as measured by patent applications and claims, influence their performance. These results emphasize the need for banks to focus on enhancing their FinTech capabilities rather than solely addressing competitive challenges. Smaller banks, in particular, can benefit from collaborating with FinTech companies to achieve more reliable business process reengineering and innovation.

- **Harmadi *et al.* (2022), "The Effect of FinTech on Conventional Bank Performance and Bank Risk".**

  The study examines the impact of financial technology (FinTech) on the performance and risk levels of conventional banks in Indonesia, focusing on 81 banks over the period from 2017 to 2021. Key findings indicate that while Peer-to-Peer (P2P) lending increases risk for conventional banks, the adoption of FinTech technology tends to reduce risk, particularly benefiting cooperative-owned banks. Interestingly, neither P2P lending nor FinTech adoption had a significant direct impact on overall bank performance. Furthermore, the study emphasizes the moderating role of bank ownership structure, showing that the interaction between FinTech variables and

ownership significantly influences bank risk, with cooperative-owned banks experiencing more pronounced benefits from FinTech adoption. These findings suggest that although FinTech can introduce risks, particularly through P2P lending, it also offers potential risk mitigation advantages when adopted strategically, especially for certain types of bank ownership structures.

The study concludes that while Peer-to-Peer (P2P) lending tends to increase the risk for conventional banks, the adoption of FinTech technology generally mitigates this risk, particularly for cooperative-owned banks. However, neither P2P lending nor the adoption of FinTech significantly affects the overall performance of these banks. Importantly, the study underscores the crucial role of a bank's ownership structure, which significantly influences how FinTech impacts bank risk. This highlights the need for banks to consider their ownership context when adopting FinTech solutions.

- **Shuli *et al.* (2022), "How Do FinTech's Impact Banks' Profitability? —An Empirical Study Based on Banks in China".**

  The study investigates the effect of financial technology (FinTech) on the profitability of Chinese banks, with a focus on the Industrial and Commercial Bank of China (ICBC) from 2011 to 2020. Using Return on Equity (ROE) as the key measure of bank profitability, the study examines the influence of FinTech development, captured by a provincial digital inclusive financial index (FTI), alongside other factors like total assets (LNTA), net interest margin (NIM), non-performing loan ratio (NPL), and cost-to-income ratio (CTI).

  To explore these relationships, the researchers applied an Error Correction Model (ECM) and a Granger causality test. The ECM helps to understand how short-term fluctuations in factors like FinTech development impact long-term profitability equilibrium, while the Granger causality test reveals whether FinTech development and bank profitability are mutually influential over time. The study shows that FinTech development and ROE are Granger causes of each other, indicating a two-way relationship. Additionally, the size of a bank's assets positively affects profitability, which in turn improves net interest margins and reduces non-performing loans.

The methodology involved regression analysis with Ordinary Least Squares (OLS), testing for stationarity using the Ng-Perron test, and adding a squared term for FinTech development to capture the nonlinear "U-shaped" impact. The research found that as banks expand their assets and improve their interest-bearing activities, profitability increases, but rising credit risks and operational inefficiencies negatively affect profitability.

The study identifies a "U-shaped" relationship between FinTech development and banks' profitability. In the early stages, FinTech disrupts traditional banking models, leading to reduced profitability due to the costs of technological investments and integration challenges. However, as FinTech matures and becomes more integrated into bank operations, it gradually boosts profitability by lowering transaction costs, improving customer experience, and enhancing operational efficiency.

The study concludes that banks should increase investments in FinTech to improve efficiency, reduce costs, and collaborate with FinTech firms to transform and stay competitive in the evolving financial landscape. Additionally, enhancing risk management systems is crucial to safeguard profits in the face of rising risks associated with FinTech development. The findings provide practical insights for banks on how to navigate the challenges and opportunities brought by FinTech, emphasizing the need for a strategic, balanced approach to technology adoption.

- **Yudaruddin *et al.* (2022), "Financial technology and bank stability in an emerging market economy".**

The study investigates the impact of financial technology (FinTech) firms on bank stability within the context of an emerging market economy, specifically focusing on Indonesia. Utilizing an empirical research design, the analysis aims to explore the relationship between the presence of FinTech firms and various dimensions of bank stability.

For data collection, the study encompasses a sample of 141 banks in Indonesia, covering a time period from 2004 to 2018. Various statistical techniques were employed to analyze this data, measuring the impact of FinTech firms on different aspects of bank stability. The sample includes both listed and non-listed banks, as well

as small and large banks, providing a comprehensive overview of the banking landscape in Indonesia.

The findings indicate that an increased presence of FinTech firms generally enhances bank stability. Notably, small banks and non-listed banks benefit more significantly, exhibiting lower levels of risk and higher capital ratios compared to their larger counterparts. This suggests that the development of FinTech can positively contribute to financial stability, especially for smaller institutions.

In terms of recommendations, the study highlights the necessity for regulatory frameworks that ensure the safety and soundness of banks while simultaneously promoting the growth of FinTech. Furthermore, it suggests that future research could delve into the long-term impacts of FinTech on various types of banks in different emerging markets. Practical applications of these findings indicate that policymakers should consider the positive influence of FinTech on bank stability when formulating regulations and policies.

The study concludes that the development of financial technology (FinTech) firms has a positive impact on bank stability in emerging markets like Indonesia. It finds that an increased presence of FinTech firms enhances overall bank stability, particularly benefiting small and non-listed banks, which demonstrate lower risk levels and higher capital ratios. Additionally, the research emphasizes the importance of establishing regulatory frameworks to ensure the safety and soundness of banks while supporting the growth of FinTech. Overall, it highlights that the advancement of FinTech can significantly contribute to financial stability, especially for smaller and non-listed banking institutions.

- **Abu Fara and Abu Karsh (2020), "The New Era of Financial Technology in Banking Industry".**

  The study on the impact of FinTech on the banking industry investigates how FinTech companies influence traditional banks, focusing on whether FinTech growth aligns with robust digital technology infrastructure and how these developments affect bank profitability. This research is important, offering insights into both the challenges and opportunities that digital finance poses for

traditional banks. The study aims to guide banks in shaping strategies to remain competitive amid the rising influence of FinTech.

The research examines data from the banking sectors of Kenya and Lithuania, two regions chosen for their distinct stages of digital and FinTech adoption. Kenya represents an emerging market with high mobile penetration, while Lithuania reflects a more developed market in the European Union with established financial regulatory frameworks. This comparative approach allows the study to assess FinTech's impact across different market dynamics and banking structures, shedding light on how FinTech influences traditional banks in diverse environments.

The study uses a literature review methodology, analyzing a range of academic publications, industry reports, and statistical data to validate two central hypotheses. The first hypothesis posits that FinTech growth is linked to the presence of digital technology and infrastructure, hypothesizing that FinTech companies emerge more readily in countries with advanced mobile and internet penetration. The second hypothesis examines whether the rise of FinTech affects the financial performance of traditional banks, specifically looking at profitability indicators such as return on assets (ROA) and return on equity (ROE).

The study finds a significant positive correlation between FinTech growth and digital technology availability. In regions like Kenya, where mobile technology adoption is high, FinTech services have flourished, exemplified by the popularity of mobile money services like M-Pesa. Lithuania also demonstrates a positive link between digital infrastructure and FinTech development, albeit with a stronger emphasis on regulatory support and financial innovation hubs.

In terms of financial performance, the study reveals mixed results. While some statistical evidence suggests that the presence of FinTech might influence bank profitability, the overall impact appears statistically insignificant in both markets. This finding implies that traditional banks, though influenced by FinTech's presence, may not yet experience drastic disruption in their profitability. Banks in these regions have maintained stability, possibly due to their established customer bases and regulatory advantages.

The study highlights several strategic recommendations for banks and policymakers. First, it suggests that banks should invest more heavily in digital technologies to strengthen their competitive positioning. By enhancing digital services, banks can offer similar convenience and accessibility as FinTech solutions, mitigating the potential loss of market share. Second, banks are encouraged to explore partnerships with FinTech companies, leveraging FinTech innovations to improve customer experience and operational efficiency.

The study also emphasizes the need for policymakers to create supportive regulatory environments that foster collaboration between banks and FinTech firms. Given the relatively stable profitability of traditional banks, this collaboration could support a more integrated financial ecosystem where both banks and FinTech companies thrive.

The authors recommend that future research explore the success and challenges of FinTech in both developed and emerging markets, analyzing regional differences in the adoption and influence of FinTech on traditional banking. Additionally, they propose that researchers further investigate the global impact of FinTech on traditional banking, specifically focusing on regulatory responses and technology investments that enable banks to maintain their competitive edge in an increasingly digital financial landscape.

In summary, this study provides a comprehensive look at the evolving relationship between FinTech and traditional banks. While FinTech is undoubtedly shaping the banking landscape, the current evidence suggests that traditional banks still retain a resilient position. However, ongoing innovation and adaptation will be essential as digital finance continues to grow and redefine consumer expectations.

- **Cheng and Qu (2020), "Riding the FinTech innovation wave: FinTech, patents and bank performance".**

The study examines the impact of financial technology (FinTech) innovation on the performance of Chinese banks, using patent data and a FinTech development index. A generalized method of moments model was applied to resolve potential endogeneity.

The study discusses the rapid rise of FinTech and its profound influence on the banking industry, helping mitigate issues like information asymmetry and lowering transaction costs. While FinTech can expand banks' business and improve performance, it also creates competition, especially in areas like online lending, which can reduce profitability. Previous research presents mixed views on whether FinTech complements or competes with traditional banking, with some studies highlighting the advantages of banks' large datasets and others noting FinTech's negative impact on lending. The study also reviews the broader literature on banking performance and FinTech, emphasizing the need for a comprehensive empirical analysis of FinTech's effect on bank performance using the CAMEL framework.

The study focuses on China, where FinTech has grown rapidly, becoming the world's largest online finance market. It uses both demand-side and supply-side metrics to measure FinTech development, incorporating factors such as financing rounds, registered capital, and the diversity of financial services offered by FinTech companies. To evaluate bank performance, the study employs the CAMEL framework, which assesses capital adequacy, asset quality, management efficiency, earning power, and liquidity.

The findings indicate that FinTech development in China significantly impacts bank performance. It enhances capital adequacy and management efficiency but diminishes asset quality and profitability. These effects became more pronounced after 2011, as FinTech began to grow rapidly. The study also uncovers a nonlinear relationship between FinTech development and bank performance, with large banks benefiting more in terms of profitability and risk control, though both large and small banks face increased credit risk. The paper makes several contributions to the literature, being the first to use patent data to measure FinTech innovation, applying the CAMEL framework to assess the comprehensive impact of FinTech on bank performance, and considering the heterogeneous effects of FinTech across different types of banks.

- **Kusuma *et al.* (2020), "Financial technology and performance in Islamic and conventional banks".**

The paper examines the impact of financial technology (FinTech) startups on the performance of Islamic and conventional banks in Indonesia. Data were collected

from a sample of 124 banks, including both conventional and Islamic banks, covering the period from 2004 to 2018. The analysis utilized a two-step generalized method of moments to estimate the system model.

The findings reveal that FinTech startups generally have a negative effect on bank performance. Furthermore, the study indicates that Islamic banks tend to underperform compared to their conventional counterparts. However, when FinTech startups engage with Islamic banks, particularly in the peer-to-peer lending sector, a higher number of FinTech startups positively influences the performance of Islamic banks. Notably, the research also shows that FinTech startups enhance the performance of Islamic banks during both normal and crisis periods.

The paper offers practical recommendations for Islamic bank management and regulators, suggesting collaboration with FinTech startups and the adoption of advanced financial technology applications to improve performance in various economic conditions. This study contributes valuable insights into the specific impacts of FinTech on Islamic banks, highlighting the importance of peer-to-peer lending and payment startups in both stable and crisis situations.

- **Zhao *et al.* (2019), "Improving Financial Service Innovation Strategies for Enhancing China's Banking Industry Competitive Advantage during the FinTech Revolution: A Hybrid MCDM Model".**

The study investigates how the rapid growth of FinTech companies has affected China's banking industry and its competitive landscape. The authors focus on how traditional banking institutions can innovate and develop service strategies to maintain a competitive edge in light of this disruption. By using service innovation theory as the foundation, the study proposes a novel hybrid multiple criteria decision-making (MCDM) model to evaluate and enhance the innovation strategies in China's banking sector during the ongoing FinTech revolution.

The research introduces a six-dimensional model to analyze the performance of Chinese banks in several key areas of service innovation. These dimensions include new business partners, new service concepts, organizational innovation, technological innovation, new customer interaction, and new revenue models. Each dimension is

further broken down into sub-criteria. The study applies a combination of three decision-making techniques: DEMATEL (Decision Making Trial and Evaluation Laboratory), DANP (DEMATEL-based Analytic Network Process), and VIKOR (a method used to rank alternatives based on their proximity to the ideal solution). This hybrid approach is used to evaluate the performance gaps in four different categories of Chinese banks: state-owned banks, joint-stock banks, city commercial banks, and other credit cooperatives.

One of the significant findings from the study is the prioritization of improvement areas for banks. The analysis reveals that the most critical area for improvement is establishing new business partnerships, followed by developing new service concepts. These areas are essential for banks to stay relevant in a financial ecosystem where FinTech companies are rapidly gaining ground through innovations like mobile payments, peer-to-peer lending, and wealth management solutions. The study also identifies the increasing need for organizational and technological innovations, as banks must adapt not only by integrating advanced technologies like big data and AI but also by restructuring their internal operations to foster innovation.

The performance evaluation conducted in the study highlights notable gaps between different types of banks. For example, state-owned banks are found to have larger gaps in organizational innovation, indicating that these institutions are slower in restructuring their internal processes to support new service offerings. In contrast, joint-equity banks and city commercial banks display deficiencies in partnerships with FinTech companies and customer interaction strategies, which suggests that while these banks may be adopting new technologies, they are not fully leveraging the potential of FinTech partnerships to improve customer experience and service delivery.

Overall, the study provides actionable strategies for banks in China to innovate in response to the FinTech revolution. It emphasizes the importance of collaboration with FinTech firms, enhancing customer interactions through digital channels, and continuously evolving service offerings to meet the changing demands of tech-savvy consumers. By focusing on these strategic areas, banks can not only survive but thrive in the increasingly competitive financial landscape shaped by technological advancements.

- **Mark and Yang (2019), "How Valuable Is FinTech Innovation?".**

  The study aims to investigate the value of technological innovations in the FinTech sector and their impact on innovators, industries, and incumbent firms. It seeks to understand how these innovations affect market dynamics and competition within the financial industry.

  The researchers constructed a large-scale dataset from the full document texts of patent applications related to FinTech innovations. They employed machine learning techniques to analyze the occurrence and significance of these innovations over the period from 2003 to 2017. The study also examined the relationship between FinTech innovations and their effects on market leaders and potential entrants.

  The sample consisted of patent applications related to FinTech innovations, with a focus on various technological advancements such as blockchain, Internet of Things (IoT), and robo-advising. The analysis included a comprehensive dataset that allowed for a robust examination of trends and impacts within the industry.

  The findings revealed that certain FinTech innovations, particularly those related to blockchain and automated financial services, hold significant value for the financial sector. The study highlighted that while disruptive technologies from nonfinancial startups can pose threats to established firms, those incumbents that actively invest in their own innovations can effectively mitigate these risks. The research provided systematic evidence of how innovation by potential entrants can influence individual firms within the industry.

  The study recommends that financial institutions should prioritize investment in technological innovations to enhance their competitive edge and safeguard against disruptive threats. It suggests that understanding the landscape of FinTech innovations is crucial for strategic planning and resource allocation. Additionally, fostering a culture of innovation within established firms can help them adapt to the rapidly evolving financial environment.

- **Peter and Chris (2018), "On the FinTech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services".**

The study provides a comprehensive analysis of the FinTech industry's rapid transformation and presents how technology innovations are reshaping the financial services sector through a FinTech innovation mapping approach to evaluate transformations in four key areas of financial services. It highlights how new technologies are reshaping operations management, enhancing efficiency and execution. It also examines how innovations like blockchain, cryptocurrencies, and cross-border payment systems are revolutionizing payment settlements and stakeholder interactions. Additionally, peer-to-peer (P2P) lending and social media are disrupting traditional lending and deposit services, while blockchain and FinTech are transforming investments, financial markets, trading, risk management, and robo-advisory services.

The authors emphasize how FinTech companies are leveraging new technologies to enhance efficiency, personalization, and customer engagement. Traditional processes in financial services, from customer interactions to backend operations, are being redefined by these innovations, resulting in the emergence of new business models. This technological shift is transforming financial services, offering consumers improved access, faster transactions, and more personalized experiences.

The study concludes that the FinTech revolution is not just a passing trend but represents a fundamental shift in the financial services industry. FinTech innovations are disrupting traditional processes, creating new business models, and transforming customer experiences. Financial institutions that fail to adapt to these changes risk becoming obsolete, while those that embrace FinTech stand to gain significant competitive advantages. The future of financial services will be defined by continued technological innovation, with FinTech leading the way in making financial services more efficient, accessible, and customer-centric.

- **Kilu (2018), "The Impact of Financial Technology on the Financial Performance of the Banking Sector in Kenya".**

In 2018, a study conducted by Kilu in Kenya aimed to investigate the impact of financial technology (FinTech) on the financial performance of the banking sector. The study encompassed all commercial banks in Kenya, totaling 44 banks. Utilizing

correlation analysis and multiple linear regression analysis, the research explored the relationship between mobile phone payments and the financial performance of banks.

The findings concluded that there is a significant positive relationship between mobile phone payments and the financial performance of banks. Specifically, the study indicated that the increasing demand for mobile phone payments contributes to the improvement of banks' financial performance, highlighting the critical role of FinTech in enhancing banking operations in Kenya.

- **Brandl and Hornuf (2017), "The Impact of FinTech on Bank Performance: An Empirical Study in Indonesia".**

  The study examines the effects of financial technology (FinTech) on the performance of banks in Indonesia, a country that has seen significant growth in the FinTech sector over the past decade. While traditional financial institutions have been slow to adopt new technologies, FinTech firms have emerged as independent players, offering innovative and cost-effective financial services. This research posits that FinTech growth negatively influences bank performance, leading to a potential substitution effect in which banks cede some of their business activities to FinTech companies.

  Grounded in consumer theory and disruptive innovation theory, the study explores how FinTech firms can replace traditional banking services by meeting the same consumer demands more efficiently. FinTech companies leverage technology to perform tasks traditionally handled by banks, such as lending, payments, and investments, thereby increasing competition in the financial market. The paper highlights that the adoption of these innovative services can enhance efficiency and lower costs, ultimately challenging the dominance of established banks.

  Utilizing bank-level data from 41 banks in Indonesia, the researchers analyzed various performance metrics, including net interest income (NIM), return on equity (ROE), return on assets (ROA), and yield on earning assets (YEA). The findings reveal a negative impact of FinTech on bank performance, with significant declines in these key metrics as new FinTech firms enter the market. Specifically, the introduction of each new FinTech firm was associated with reductions in NIM, ROE, ROA, and YEA, indicating that the presence of FinTech negatively predicts these performance measures.

The study also investigates how specific bank characteristics, such as market value and firm age, influence the extent to which FinTech affects bank performance. The results show that larger and more mature banks are more adversely affected by FinTech compared to smaller and newer banks. Moreover, state-owned banks experience a greater impact from FinTech than private banks.

To ensure the robustness of their findings, the researchers conducted multiple tests using various measures of bank performance. They found consistent negative effects of FinTech on bank performance across different contexts, although a slight positive effect was noted for younger banks. The study concludes that FinTech poses significant challenges to traditional banks, emphasizing the need for these institutions to adapt and innovate in order to maintain their competitive edge in the evolving financial landscape. Overall, this research provides valuable insights into the relationship between FinTech growth and bank performance, contributing to the understanding of this dynamic within emerging markets.

- **Schueffel (2016), "Taming the Beast: A Scientific Definition of FinTech".**

The Study aims to establish a clear and comprehensive definition of "FinTech" by reviewing over 200 scholarly articles spanning more than 40 years. The objective is to create a definition that is both distinct and sufficiently broad to encompass various applications within the financial technology space.

Using semantic analysis, the author examines commonalities among 13 peer-reviewed definitions of FinTech, distilling its essence from both academic and practical perspectives. The study concludes that FinTech represents a new financial industry that utilizes technology to enhance financial activities, including innovations like internet banking, mobile payments, crowdfunding, peer-to-peer lending, robo-advisory services, and online identification.

Additionally, the paper discusses the implications and potential shortcomings of this definition, highlighting FinTech's significant and lasting impact on the financial services industry. It emphasizes how FinTech drives innovation and poses challenges to traditional financial practices. This foundational understanding underscores

FinTech's transformative role in the financial sector through technological advancements.

The study concludes that FinTech represents a new financial industry that leverages technology to enhance financial activities. This definition emerges from a comprehensive semantic analysis of over 200 scholarly articles, identifying commonalities among 13 peer-reviewed definitions. The research emphasizes FinTech's significant and lasting impact on the financial services sector, highlighting its role in driving innovation and potentially disrupting traditional financial practices.

- **Philippon (2016), "The Impact of FinTech on Banking: Evidence from the U.S.".**

The study examines a diverse range of U.S. banks, including large national institutions and regional entities. By drawing on data from regulatory filings, performance reports, and market analyses, the researcher captures a comprehensive view of the banking landscape and its evolving dynamics in relation to FinTech.

The study employs an empirical analysis methodology, utilizing quantitative methods to assess key performance metrics of banks over time. Philippon examines indicators such as return on assets (ROA), cost-to-income ratios, and market share. Additionally, the research explores the relationship between traditional banks and emerging FinTech firms, focusing on both competitive pressures and collaborative efforts. Statistical models are used to measure the impact of FinTech on banking efficiency and profitability.

Findings from the study reveal that the rise of FinTech has significantly increased efficiency within traditional banks, prompting many institutions to adopt new technologies that streamline operations and reduce costs. The presence of FinTech firms has intensified competition in the banking sector, leading to innovations in products and services that ultimately benefit consumers. Moreover, the research highlights a growing trend of collaboration between banks and FinTech companies, with traditional banks leveraging FinTech solutions to enhance their service offerings and reach new markets.

Based on these findings, Philippon offers several recommendations. He advises banks to invest in technological advancements to maintain competitiveness and improve

operational efficiency. Additionally, he suggests that banks explore strategic partnerships with FinTech firms to harness innovative solutions that can elevate customer experiences. Lastly, the study calls for policymakers to adapt regulatory frameworks to accommodate the evolving landscape of financial services, ensuring that both traditional banks and FinTech companies can operate effectively and securely.

2.4.2 Local and Arabic Countries Previous Studies

- **Abu Fara and Abu Karsh (2023), "The Administrative, Financial, and Technological Requirements for the Success of the Financial Technology Industry in the Arab Countries".**

  This study highlights the critical role that administrative, financial, and technological requirements play in the success of financial technology (FinTech) within Arab countries. Ensuring these requirements are met supports the enhancement of service quality across financial and banking institutions, enabling these institutions to maintain adequate liquidity levels, maximize profitability, and efficiently address operational and regulatory challenges. Furthermore, achieving these requirements contributes to offering customers a higher quality of service, encouraging economic diversification, promoting financial stability, and advancing financial inclusion—especially for financially underserved groups. This study's importance is magnified by its focus on FinTech, an area experiencing rapid growth that is capable of reducing costs, improving efficiency, and broadening access to financial markets and products.

  The objectives of this study include pinpointing the administrative, financial, and technological requirements necessary for the successful implementation of FinTech in Arab nations. Specifically, it seeks to identify the management and financial prerequisites essential for fostering a thriving FinTech industry, as well as the technological infrastructure and tools required to ensure FinTech's success in this region. This focus is timely, given the increasing adoption of digital financial services in Arab markets and the potential these technologies have to transform financial services through innovation and inclusion.

  The study model developed by the researchers presents a conceptual framework that examines the relationship between key independent variables—administrative,

financial, and technological requirements—and the dependent variable of FinTech success in Arab countries. This model allows for an organized analysis of how these different factors influence the overall effectiveness and sustainability of FinTech applications within Arab financial institutions.

Employing a descriptive research methodology, the study collected and analyzed data from a sample of academics, bankers, and IT professionals across several Arab countries, such as Palestine, Kuwait, Saudi Arabia, and Egypt. The researchers distributed 200 electronic questionnaires between April and May 2020, receiving 129 completed responses suitable for statistical analysis. These responses offered insights from experts familiar with the challenges and requirements of implementing FinTech across the Arab region, forming a diverse representation of perspectives within financial, academic, and technological fields.

The study's findings on administrative and financial requirements reveal several essential elements for FinTech success in Arab countries. These include maintaining high-quality inputs, mechanisms, and outputs within FinTech systems, fostering effective customer interactions, and ensuring the rapid processing of FinTech data. Additionally, support for liquidity within electronic markets through varied financial products is essential, as this helps provide stability and facilitates smooth financial operations.

Regarding technological requirements, the study identifies key infrastructure elements necessary for sustaining FinTech applications. These include the proper application of blockchain technology in financial services, the provision of electronic platforms, technological guarantees for system sustainability, and an integrated system for delivering digital financial advice. The study also emphasizes the need for a central network that integrates decentralized network features, which could facilitate the launch of an Arab virtual currency to strengthen financial transactions across the region.

In light of these findings, the study provides several administrative and financial recommendations to support FinTech's success in Arab countries. One primary recommendation is to prioritize quality at all stages of FinTech system implementation, from inputs to customer interactions. Ensuring effective and rapid

data processing is critical to achieving seamless FinTech operations. Additionally, providing the necessary financial support mechanisms is crucial for enabling sufficient liquidity in digital markets, which would help stabilize the industry and ensure a reliable financial environment for customers.

The study also offers technological recommendations, urging the development and responsible use of blockchain applications across financial sectors, the establishment of electronic lending and investment platforms, and the promotion of crowdfunding. Additionally, it emphasizes the importance of an automated system for electronic financial advice and proposes developing a decentralized network to facilitate the introduction of an Arab digital currency. Such a currency could improve transaction efficiency, reduce cross-border barriers, and establish a unified digital financial ecosystem within the Arab world.

Finally, the study puts forth general recommendations for advancing FinTech in the region. These include accelerating banking reforms to align with global standards, fostering mergers among Arab banks to address issues of limited capital, enhancing the operational efficiency of banking activities, and ensuring compliance with Basel Committee standards on capital adequacy and risk management. Furthermore, it advocates for modernizing banking legislation, diversifying funding sources, and creating savings tools such as international deposit certificates. Improvements in human resource capabilities and the adoption of digital marketing in financial services are also highlighted as necessary steps toward achieving a more dynamic and resilient financial sector within the Arab region.

- **Alnsour (2023), "The Effect of Financial Technology on Islamic Banks' Performance in Jordan: Panel Data Analysis".**

The study investigates the influence of FinTech on the performance metrics of Islamic banks in Jordan, particularly focusing on profitability and efficiency. Utilizing panel data analysis over the period from 2010 to 2020, the researchers gathered data from various Islamic banks in Jordan and applied statistical models to explore the relationship between FinTech adoption and bank performance. Key findings indicate that FinTech adoption positively impacts the performance of Islamic banks, enhancing profitability and operational efficiency while also improving risk

management and reducing overall risk exposure. Additionally, the study highlights increased customer satisfaction driven by enhanced service delivery and accessibility through FinTech solutions. The implications suggest that Islamic banks in Jordan should continue investing in FinTech to bolster their performance and competitiveness, with a call for policymakers to support FinTech initiatives to create a more robust banking sector.

The study concludes that the adoption of financial technology (FinTech) positively influences the performance of Islamic banks in Jordan, specifically enhancing profitability and operational efficiency. It also contributes to improved risk management, thereby reducing the overall risk exposure for these banks. Furthermore, FinTech adoption is associated with increased customer satisfaction due to better service delivery and accessibility. The study recommends that Islamic banks continue to invest in FinTech to further enhance their performance and competitiveness in the market.

- **Mashhadani *et al.* (2023), "The Impact of Financial Technology on Banking Performance: A Study on Foreign Banks in UAE".**

  The Study investigates how financial technology (FinTech) influences the performance of foreign banks operating within the UAE. It aims to assess the relationship between FinTech adoption and key performance metrics such as Return on Assets (ROA) and Return on Equity (ROE). Utilizing a quantitative approach, the research analyzes data from 19 foreign banks over several years to comprehensively evaluate FinTech's impact. The findings reveal a significant positive relationship between FinTech adoption and bank performance, indicating that FinTech enhances both ROA and ROE. Additionally, the adoption of FinTech contributes to improved operational efficiency and helps banks attract more customers, thereby further boosting their profitability. The study recommends that foreign banks in the UAE should continue investing in FinTech to enhance their performance and underscores the importance of FinTech in informing investment decisions and improving customer satisfaction.

  The study concludes that the adoption of financial technology (FinTech) has a positive and significant impact on the performance of foreign banks in the UAE. Specifically,

it shows that FinTech adoption enhances both Return on Assets (ROA) and Return on Equity (ROE), which reflects improved profitability and operational efficiency. The findings suggest that foreign banks should continue to invest in FinTech to further boost their performance and attract more customers. This aligns with broader trends in the banking sector where FinTech is increasingly recognized as a driver of competitiveness and customer engagement.

- **Baker *et al.* (2023), "Impact of Financial Technology on Improvement of Banks' Financial Performance".**

  The study investigates the impact of financial technology (FinTech) on the financial performance of commercial banks listed on the Amman Stock Exchange (ASE) and the Abu Dhabi Securities Exchange (ADX) during the period from 2012 to 2020. Researchers collected data through 115 questionnaires distributed among commercial banks in Jordan and the UAE, focusing on financial performance measured by total deposits and net profits as the dependent variables, while FinTech adoption served as the independent variable. To analyze the data, multiple linear regression analysis was employed to test the hypotheses. Key findings reveal that FinTech adoption positively influences both total deposits and net profits, indicating enhanced operational efficiency and improved financial performance. The study recommends that banks implement inclusive FinTech strategies to promote sustainable development within the financial sector.

  The study concludes that the adoption of financial technology (FinTech) significantly enhances the financial performance of commercial banks listed on the Amman Stock Exchange and the Abu Dhabi Securities Exchange. Specifically, FinTech adoption leads to increases in both total deposits and net profits. Additionally, the study highlights the role of FinTech in improving operational efficiency and its potential contribution to sustainable development. It recommends that banks implement inclusive FinTech strategies to further enhance their financial performance and support sustainable growth in the banking sector. These findings underscore the importance of FinTech in modern banking practices, reflecting broader trends in the financial industry.

- **Kaddumi *et al.* (2023), "Does Financial Technology Adoption Influence Bank's Financial Performance: The Case of Jordan".**

  The study investigates the effect of FinTech adoption on the financial performance of conventional banks listed on the Amman Stock Exchange (ASE). It aims to assess how FinTech adoption influences financial performance indicators such as total deposits, total loans, and net profit margin. The researchers collected data from commercial banks in Jordan covering the period from 2012 to 2020, using a questionnaire that focused on three key dimensions of FinTech: financial inclusion (FI), alternative payment methods (APMs), and automation (Auto). A total of 115 questionnaires were distributed, and multivariate regression analysis was employed to evaluate the impact of these dimensions. The findings indicate that all three FinTech dimensions positively and significantly impact the financial performance indicators of Jordanian commercial banks. Specifically, increased financial inclusion led to higher total deposits and loans, while the adoption of alternative payment methods improved net profit margins, and automation contributed to operational efficiency. The study suggests that banks should invest more in FinTech tools and applications to attract and retain clients, thereby maintaining their competitive edge in the banking sector. This underscores the crucial role of FinTech in enhancing the financial performance of banks through improved financial inclusion, alternative payment methods, and streamlined processes.

  The study concludes that the adoption of financial technology (FinTech) positively and significantly impacts the financial performance of conventional banks listed on the Amman Stock Exchange. Specifically, it indicates that FinTech adoption enhances key performance indicators, including total deposits, total loans, and net profit margin. The findings suggest that banks should increase their investments in FinTech tools and applications to effectively attract and retain clients, thereby maintaining a competitive edge in the banking sector. This highlights the critical role of FinTech in driving performance improvements and adapting to the evolving financial landscape.

- **Alshira'h *et al.* (2023), "The Effect of Financial Technology on Financial Performance in Jordanian SMEs: The Role of Financial Satisfaction".**

The study explores how adopting financial technology (FinTech) influences the financial outcomes of small and medium-sized enterprises (SMEs) in Jordan, specifically through the lens of financial satisfaction. Using Partial Least Squares-Structural Equation Modeling (PLS-SEM) to analyze data from 500 SMEs, the research indicates that FinTech adoption not only directly enhances financial performance, but that financial satisfaction significantly mediates this relationship.

The study's findings indicate that FinTech adoption significantly enhances the financial performance of SMEs in Jordan. It also reveals that financial satisfaction mediates the relationship between FinTech adoption and performance, suggesting that satisfied customers tend to achieve better financial results. Moreover, financial satisfaction itself is shown to have a considerable impact on overall financial performance. These insights emphasize the importance of understanding factors affecting customer satisfaction and FinTech adoption, providing useful implications for financial service providers and policymakers in Jordan and similar economies.

The study concludes that adopting financial technology (FinTech) has a positive impact on the financial performance of Jordanian SMEs. This effect is mediated by financial satisfaction, indicating that higher FinTech adoption leads to increased customer satisfaction, which further enhances financial performance. The findings highlight the importance of understanding customer satisfaction and FinTech adoption to improve financial outcomes for SMEs in Jordan.

- **Bukhari (2022), "The Role of Financial Technology in Developing the Performance of the Islamic Banking Industry".**

The study investigates the role of financial technology (FinTech) in enhancing the performance of the Islamic banking industry across selected countries, specifically Malaysia, Saudi Arabia, and Kuwait. The research aims to highlight the current state of FinTech utilization in Islamic banks by showcasing the experiences of these countries. A questionnaire was distributed to decision-makers in the banking sector to gather insights on the impact and challenges of FinTech.

The findings indicate that FinTech significantly contributes to the sustainable development of the Islamic financial industry by introducing innovative solutions,

tools, and new financial products. This technological advancement is also associated with reducing financing risks and promoting financial inclusion, thereby expanding access to banking services for underserved populations.

However, the study also identifies several challenges associated with the adoption of FinTech in Islamic banking. Cultural factors, the difficulty of adapting to and controlling new technologies, and resistance to change are highlighted as major obstacles. These challenges hinder the effective integration of modern technology within banks, suggesting that a supportive cultural and organizational environment is crucial for the successful implementation of FinTech solutions in the Islamic banking sector.

- **Boulta and Bargha (2022), "The Impact of Financial Technology on the Performance of Banks in Algeria".**

  The study was conducted in Algeria to examine the impact of financial technology (FinTech) on the performance of banks. The researchers utilized a questionnaire as the primary data collection tool, distributing it to a sample of employees from three local banks. The findings revealed a strong inclination toward adopting financial technology among the banks studied. Additionally, the results indicated a relationship between the adoption of FinTech and improved bank performance. However, the study concluded that the implementation of financial technology in the participating Algerian banks had not yet reached a sufficient maturity stage, suggesting that further development and integration of FinTech solutions are necessary for optimal performance enhancement.

- **Dwivedi *et al.* (2021), "Role of FinTech Adoption for Competitiveness and Performance of the Bank: A Study of Banking Industry in UAE".**

  The study aimed to explore the influence of financial technology (FinTech) adoption on the competitiveness and performance of the banking industry in the region. The empirical investigation involved 76 banking professionals and executives from Dubai, UAE. The researchers designed a questionnaire informed by inputs from banking executives, a comprehensive literature review, and pre-testing, structuring it into two sections for participant convenience. The first section gathered demographic

information, including age, gender, years of experience, and job positions. The second section focused on FinTech adoption, competitiveness, and performance within the banking industry.

The results indicated a significant positive impact of FinTech adoption on both competitiveness and performance in the UAE banking sector. The study emphasized that effective FinTech adoption, combined with sound technology management practices, directly enhances the banking industry's performance. This research is particularly relevant as the UAE banking industry serves a diverse clientele of nearly 200 nationalities and relies heavily on FinTech and competitiveness for overall success.

- **Momani and Alomari (2021), "Financial Technology (FinTech) and its Role in Supporting the Financial and Banking Services Sector".**

The study explores how FinTech is reshaping the financial and banking sectors by introducing advanced technological innovations that improve service delivery and operational efficiency. The authors explain FinTech as a broad range of products and services that rely on technology to optimize financial services, including mobile payments, money transfers, lending, and asset management. These services are typically driven by startups that either collaborate or compete with traditional financial institutions. The study highlights that the financial services sector is undergoing a transformation driven by FinTech, with investments in the industry projected to reach $15 billion by 2022. The adoption of FinTech is driven by the need for more innovative and efficient financial services that meet the growing demands of consumers. The authors discuss the definition of FinTech as the application of innovative technologies to financial services, emphasizing its potential to disrupt traditional banking models. They highlight the importance of creating an enabling ecosystem and regulatory framework to promote the growth of FinTech startups, particularly in less developed countries.

the authors focus on the growing impact of FinTech in the MENA region. They note that FinTech startups in this region are increasingly attracting investment, with funding rising by 270% between 2017 and 2018. The UAE, Lebanon, Jordan, and Egypt are leading hubs for FinTech innovation in the region. The MENA region has

witnessed a surge in FinTech startups offering payment solutions and lending services, which are essential for promoting financial inclusion and SME growth.

The paper highlights the importance of regulatory frameworks in the MENA region to foster FinTech development. For example, the Abu Dhabi Global Market's "Regulatory Lab" was established as a FinTech sandbox, providing a controlled environment for FinTech startups to innovate while complying with regulatory requirements.

While FinTech presents numerous opportunities, the authors acknowledge challenges that must be addressed. One significant challenge is the need for robust information and communication technology (ICT) infrastructure to support FinTech services. Additionally, there is a need for clear regulatory frameworks to manage risks associated with new financial products and services. Cybersecurity is also a concern, as the increased reliance on digital platforms exposes financial institutions to potential cyberattacks.

Partnerships between traditional banks and FinTech companies present significant opportunities for both parties. Banks can benefit from FinTech innovations that streamline processes, improve customer experience, and reduce operational costs. On the other hand, FinTech companies can leverage banks' established customer bases and infrastructure to expand their reach.

The paper concludes by emphasizing that FinTech has the potential to revolutionize the financial services sector by making financial services more accessible, efficient, and secure. However, to realize these benefits, there must be a concerted effort to develop supportive regulatory frameworks, improve ICT infrastructure, and enhance cybersecurity measures. The authors recommend that policymakers focus on promoting financial awareness, easing restrictions on foreign investments, and developing risk management frameworks tailored to the unique challenges posed by FinTech innovations.

The study provides a comprehensive overview of FinTech's role in the financial services sector, underscoring its potential to drive significant improvements in efficiency, financial inclusion, and service delivery. It also highlights the importance

of collaboration between FinTech startups and traditional financial institutions in shaping the future of the financial industry.

- **Abu Daqar *et al*. (2020), "Fintech in the eyes of Millennials and Generation Z (the financial behavior and Fintech perception)".**

  The study on Fintech perceptions among Millennials and Generation Z in Palestine provides a nuanced understanding of how these younger generations perceive and intend to use Fintech services, as well as their financial behaviors in a growing digital finance landscape. By focusing on Palestinian youth, the study sheds light on an underserved and rapidly evolving market, offering valuable insights for banks and Fintech providers aiming to cater to these key demographics.

  The research, conducted with a sample of respondents from the West Bank, used a questionnaire distributed via social media platforms to collect data, emphasizing convenience and accessibility for a digitally engaged audience. The questionnaire was designed to assess key factors, including awareness of Fintech services, levels of trust, usage intentions, and specific preferences for financial services.

  The findings reveal several important trends. Notably, 48% of Millennials and 38% of Generation Z respondents were aware of Fintech services, indicating moderate awareness levels across age groups. However, the study uncovered a strong interest in adopting Fintech, with 84% of participants expressing intentions to use e-wallet services, highlighting a considerable demand for digital financial solutions. Additionally, preferences for real-time services were high among both Millennials (87%) and Generation Z (70%), underlining the importance of speed and immediacy in financial transactions for younger consumers.

  A notable 85% of respondents indicated trust in banks, suggesting that, in the Palestinian context, Fintech services are seen as complementary rather than disruptive to traditional banking. This trust in established banks can be a significant factor in shaping how Fintech and banking partnerships evolve to benefit both industries.

  Furthermore, cost-effectiveness emerged as a key factor, with most participants viewing Fintech services as more affordable than traditional banking options. This cost advantage of Fintech solutions could be a decisive factor in their increased

adoption, particularly among Generation Z, who are more likely to be unbanked and less experienced with traditional banking systems.

Based on these insights, the researchers suggest that banks and Fintech providers should leverage promotional campaigns to motivate customers to adopt electronic financial services. Banks, in particular, are encouraged to digitize their services to meet the preferences of younger customers. Additionally, the study highlights Generation Z as a valuable target segment for Fintech, as one-third of this demographic remains unbanked. By offering virtual accounts through user-friendly e-wallet services, banks could attract this unbanked segment, expanding their customer base and bridging the gap between traditional and digital financial services.

In conclusion, this study emphasizes the importance of innovation and adaptation in response to the evolving preferences of Millennials and Generation Z. For traditional banks, enhancing their digital offerings and collaborating with Fintech providers could be crucial to staying competitive in a landscape increasingly driven by the demands of younger, tech-savvy consumers.

2.5 Conclusion of Literature Review and Previous Studies

This section synthesizes the key findings from a wide range of studies examining the impact of FinTech on the banking sector. As FinTech continues to reshape financial services globally, it is essential to understand how different regions, banking institutions, and regulatory environments are affected. The reviewed literature offers critical insights into how FinTech innovations influence bank performance, operational efficiency, customer satisfaction, and sustainability efforts. It also highlights the challenges and knowledge gaps that need to be addressed to maximize the benefits of FinTech. This section draws together these findings, providing a cohesive overview of FinTech's transformative role and identifying the strategic actions banks and policymakers should consider adapting to the rapidly evolving financial landscape. The reviewed studies investigate the impact of FinTech innovations and banking performance across different regions, types of banks, and specific contexts.

One key finding from previous studies is that FinTech adoption has demonstrated a more significant positive impact in less developed countries, where it plays a critical role in improving financial performance indicators. The key reason for this improvement lies in FinTech's ability to provide cost-effective financial services to unbanked and underbanked populations. In these regions, FinTech solutions help reduce barriers to access, offering affordable services that were previously out of reach for many, thus contributing to overall banking efficiency.

In contrast, FinTech's effect in wealthier countries shows a different trend. While it brings technological advancements, it also increases operational costs, leading to minimal efficiency gains. Consequently, banks in developed nations often experience a rise in the cost-to-income ratio, indicating that FinTech's cost-saving potential may be less impactful in these regions compared to less developed markets.

Another significant finding is that the adoption of FinTech in local banks has had a distinctly positive influence. It has boosted profitability, improved operational efficiency, and enhanced risk management capabilities. Additionally, FinTech's introduction has led to higher customer satisfaction levels due to more accessible and efficient banking services. Similarly, foreign banks operating have also benefited

from FinTech, with improvements in key performance metrics such. FinTech adoption has not only increased profitability but also contributed to better operational efficiency and customer engagement.

Some of the studies indicate FinTech innovation presents a mixed outcome. On one hand, it has helped banks improve their capital adequacy and management efficiency. On the other hand, it has negatively affected asset quality and profitability, highlighting the complex trade-offs FinTech can bring to large financial institutions in this rapidly evolving market.

In terms of FinTech's specific impacts, commercial banks have seen increases in total deposits and net profits as a result of FinTech adoption. These improvements point to FinTech's role in enhancing the financial performance of major banks. Furthermore, for small and medium-sized enterprises (SMEs), FinTech adoption has been a key driver of enhanced financial performance, with customer satisfaction acting as a significant mediator in this relationship.

Moreover, FinTech innovations are playing a significant role in promoting green growth, as several studies have shown their ability to facilitate improvements in green credit and green investment. This underscores FinTech's potential to drive sustainable economic practices. Additionally, banks with cooperative ownership structures have benefited from FinTech through enhanced risk reduction, particularly in mitigating risks associated with Peer-to-Peer lending. These findings emphasize the critical role that ownership structure plays in determining how effectively FinTech can manage and reduce financial risks.

In conclusion, the researcher inventions that previous studies finds that FinTech adoption has a generally positive effect on the performance of both conventional and Islamic banks, enhancing various key metrics such as profitability, operational efficiency, customer satisfaction, and risk management. These improvements are especially pronounced in less developed countries, where FinTech facilitates greater access to banking services for unbanked populations. By providing innovative solutions and cost-effective services, FinTech helps bridge the gap in financial access, thus driving overall banking performance. In contrast, developed countries experience

more limited efficiency gains from FinTech adoption, often accompanied by increased operational costs, which can offset some of the potential benefits.

In addition to its impact on financial performance, FinTech is increasingly contributing to green economic growth. Here, FinTech innovations are playing a crucial role in improving green credit and investment, demonstrating the technology's capacity to support sustainability initiatives. This involvement in green finance suggests that FinTech can extend its influence beyond profitability, aligning itself with broader sustainability goals. By integrating environmentally friendly practices into financial services, FinTech has the potential to foster a more sustainable economic landscape while continuing to drive financial innovation.

The knowledge gaps identified in the previous literature review can be summarized as follows:

- **Long-Term Impacts of FinTech**

  While the short-term impacts of FinTech on profitability and operational efficiency are well-documented, there is a significant lack of research regarding the long-term effects of these technologies. Understanding how FinTech shapes the overall sustainability of financial institutions is critical, as institutions need to ensure that the benefits gained in the short term do not come at the expense of long-term viability. This gap in knowledge highlights the necessity for studies that explore the enduring implications of FinTech adoption within the banking sector.

- **FinTech and Regulatory Frameworks**

  Another area requiring further exploration is the role of regulatory frameworks in facilitating the integration of FinTech and minimizing associated risks. The existing literature indicates a pressing need for enhanced supervision and regulation of FinTech innovations, particularly in emerging markets where these technologies are rapidly evolving. As FinTech continues to disrupt traditional banking models, it is essential to develop comprehensive regulatory frameworks that can safeguard both financial stability and innovation.

- **Cultural and Organizational Challenges**

  Cultural and organizational challenges also represent a significant knowledge gap in the adoption of FinTech, particularly within Islamic banking. Resistance to technological change is frequently cited as a major obstacle, yet there is limited research into how cultural factors influence the adoption and integration of FinTech across different regions. Understanding these cultural dynamics is crucial for designing effective strategies that promote the successful implementation of FinTech solutions in diverse banking environments. Addressing this gap could help facilitate smoother transitions toward FinTech integration, ultimately benefiting both financial institutions and their customers.

The previous study provided a series of recommendations that should be prioritized, which can be summarized as follows:

- **Tailored FinTech Strategies**

  The differential impact of FinTech based on a country's economic development highlights the necessity for banks to adopt region-specific strategies. In less developed countries, the focus should be on utilizing FinTech to expand financial inclusion, ensuring that underserved populations gain access to essential banking services. Conversely, banks in more advanced economies should prioritize strategies that enhance efficiency gains and mitigate risks associated with FinTech adoption. By tailoring their approaches to the unique circumstances of their regions, banks can maximize the benefits of FinTech.

- **Collaboration with FinTech Firms**

  Both Islamic and conventional banks are encouraged to foster collaborations with FinTech companies to boost profitability, enhance customer satisfaction, and improve competitiveness. Establishing partnerships between traditional banks and FinTech firms allows both parties to leverage each other’s strengths, combining the technological innovations of FinTech with the established customer bases and trust of traditional banks. Such collaborations

can lead to the development of innovative financial products and services that better meet the evolving needs of consumers.

- **Strengthen Regulatory and Risk Management Frameworks**

  To effectively mitigate the risks associated with FinTech, particularly in the realms of Peer-to-Peer lending and asset quality management, banks should enhance their risk management systems. This includes adopting robust frameworks that can identify, assess, and manage the unique risks posed by FinTech innovations. Simultaneously, policymakers must establish comprehensive regulatory frameworks that support FinTech innovation while ensuring the stability of the financial system. A balanced approach will foster a safe environment for FinTech growth and integration.

- **Focus on Green Finance**

  Given the potential of FinTech to support green economic growth, especially in emerging markets, banks and policymakers should actively promote FinTech innovations that align with sustainability goals. Initiatives that facilitate green credit and investment mechanisms can harness FinTech's capabilities to contribute positively to environmental objectives. By integrating sustainability into their FinTech strategies, banks can play a pivotal role in advancing green finance and addressing pressing global challenges.

- **Address Organizational and Cultural Resistance**

  For Islamic banks and other institutions facing resistance to FinTech adoption, it is essential to create a supportive cultural and organizational environment. This may involve implementing targeted training programs and change management strategies to foster a culture that embraces technological advancements. By addressing the cultural barriers that hinder FinTech integration, banks can enhance their adaptability and ensure a smoother transition into the digital financial landscape.

Finally, the studies collectively indicate that FinTech is reshaping the banking sector by enhancing financial performance, improving customer satisfaction, and fostering

greater competitiveness. However, its effects vary by region, type of bank, and ownership structure. The key takeaway is that banks must adapt their FinTech strategies to their specific circumstances whether they focus on financial inclusion in less developed countries or cost efficiency and customer engagement in more advanced economies. Regulatory frameworks and risk management systems must evolve alongside FinTech to ensure that the benefits of these technologies are fully realized, particularly in areas like green finance and sustainable development.

Chapter 3: Methodology of The Study

3.1 Study Design and Approach

This study investigates the influences of FinTech adoption on Palestinian Banks' ability to compete effectively within the financial sector by examining its role in enhancing critical financial performance metrics, including profitability, competitiveness, and overall financial health. By analyzing the relationship between FinTech adoption and these significant aspects, the research focused on how technological advancements impact both the competitiveness of banks and their financial performance, providing a comprehensive understanding of the transformative effects of FinTech in the Palestinian banking sector.

The study depended on secondary data to be collected from the World Bank databases, financial statements, and reports of various banks. The World Bank data included key economic indicators such as GDP growth and inflation rates. While the financial statements provided detailed insights into banks' financial performance and competitiveness metrics. The gathered data were used to develop a model by Response Surface Methodology (RSM).

Response Surface Methodology (RSM) encompasses a set of mathematical and statistical approaches designed to model and investigate situations where a particular outcome is affected by multiple factors. The goal of RSM is to enhance this outcome by examining the connections between the variables and the response. Typically, this involves fitting a polynomial equation to the response data, allowing researchers to determine the best conditions for achieving the desired results ***(Myers & Montgomery, 2002)***.

RSM has proven effective in financial modeling using historical data. This methodology allows for relationship examinations between various financial indicators and outcomes, such as returns, risks, and pricing strategies. RSM improves our understanding of how distinct financial variables interact and impact significant performance metrics, providing deeper insights into market dynamics. Additionally, it enables the identification of optimal conditions for investment strategies or portfolio allocations by analyzing past performance data. RSM also facilitates scenario testing,

allowing analysts to simulate various market conditions and their potential effects on financial outcomes. By modeling the interplay between risk factors and financial performance, RSM aids in developing strategies to minimize conceivable losses. As a result, RSM offers a systematic approach to navigating complex financial models, harnessing historical data to refine decision-making processes ***(Duan & Fulop, 2013; Nocedal & Wright, 2006)***.

3.2 Study Population and Sample

This section outlines the defined population and the carefully selected sample, which served as the foundation for the analysis in this dissertation. The inclusion criteria not only enhance the study's validity but also ensure a comprehensive understanding of the dynamics within the Palestinian banking sector concerning FinTech advancements.

The study population utilizes a comprehensive survey approach, which includes all banks operating in Palestine (both listed and unlisted banks on the stock exchange) that were registered with the Palestine Monetary Authority (PMA) during the period from 2015 to 2022. According to the PMA, as of June 2024, the Palestinian banking sector comprised 13 banks, including seven local and six foreign banks. The foreign banks comprised five from Jordan and one from Egypt. This population provides a comprehensive overview of the banking landscape in Palestine, allowing for a thorough examination of the impact of FinTech on financial performance. Table No. (3.1) presents the study population, which includes the 13 banks operating in Palestine. These banks represent a mix of local and foreign, varying in size, and bank type providing a comprehensive overview of the banking sector in Palestine.

Table No. (3.1): Study Population

Bank Name	Nationality	Year of Establishment	Bank Type	Reporting Currency	Number of Branches & Offices As of 2023	Number of Employees As of 2023	Total Assets (USD) As of 2023
Bank of Palestine	Palestinian	1960	Commercial	USD	75	1,790	7,126,060,748
Arab Bank	Jordanian	1994	Commercial	JOD	34	920	5,057,305,808
Arab Islamic Bank	Palestinian	1996	Islamic	USD	29	706	1,738,370,083
Palestine Islamic Bank	Palestinian	1997	Islamic	USD	43	721	1,569,277,555
Quds Bank	Palestinian	1995	Commercial	USD	39	750	1,508,701,487
The National Bank	Palestinian	2006	Commercial	USD	37	725	1,490,863,965

Cairo Amman Bank	Jordanian	1986	Commercial	JOD	22	440	1,142,995,676
Bank of Jordan	Jordanian	1994	Commercial	JOD	43	342	861,585,236
Palestine Investment Bank	Palestinian	1995	Commercial	USD	22	312	792,247,173
The Housing Bank for Trade & Finance	Jordanian	1995	Commercial	JOD	15	314	774,184,150
Jordan Ahli Bank	Jordanian	1995	Commercial	JOD	10	223	578,926,286
Safa Bank	Palestinian	2016	Islamic	USD	9	182	426,637,931
Egyptian Arab Land Bank	Egyptian	1994	Commercial	USD	7	154	NA

The study sample includes all banks operating in Palestine. To ensure the reliability and validity of the analysis, banks that did not provide complete essential data or sufficient disclosures for the study were excluded. This selection criterion ensures that the sample comprised banks with complete and accessible financial records, enabling a robust analysis of the effects of FinTech innovations on their competitiveness and financial performance metrics. The year 2023 will be excluded from the analysis due to ongoing geopolitical tensions in Palestine. These tensions are anticipated to significantly affect the economic variables, potentially distorting the results, and undermining their reliability.

The choice to include both local and foreign banks or Islamic and traditional is critical for understanding the diverse impact of FinTech adoption levels across different types of banks operating in Palestine. By considering a range of banks, the study aims to capture variations in how FinTech adoption influences bank financial performance, operational efficiency, and market share across (competitiveness) different bank contexts. Following the PMA requirements, foreign banks must prepare and disclose separate financial statements for their branches in Palestine, independent from the main bank.

3.3 Study Variables

When studying the relationships between FinTech adoption and bank financial performance and competitiveness, it's crucial to understand how certain financial variables relate to this emerging sector. The nature of the relationship between the study variables can be illustrated through the following Figure No. (3.1).

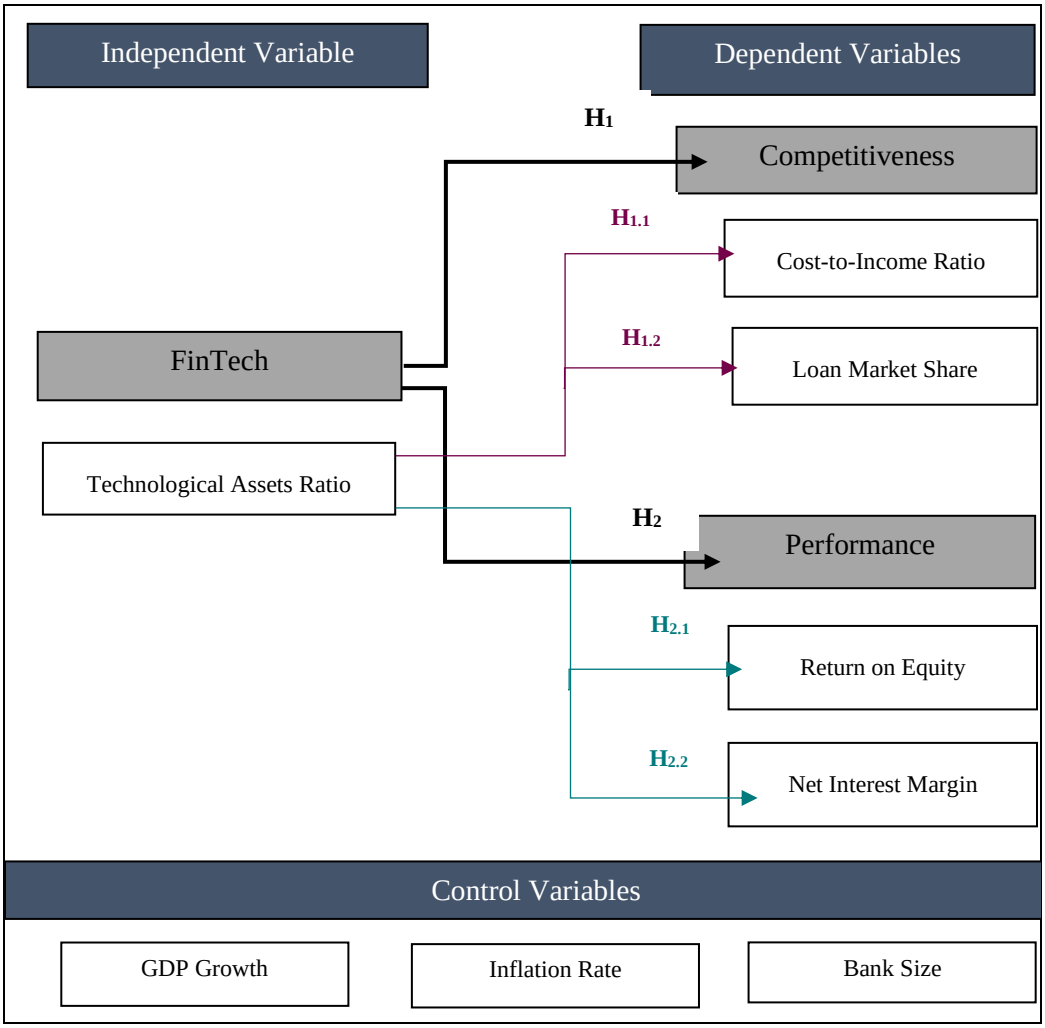

Figure No. (3.1): Study Model, Designed by the researcher.

- **Independent Variables (Parameters)**

The choice of independent variables is critical because they help establish the foundation for hypothesis testing and can influence the validity of the research findings ***(Creswell, 2014).*** Researchers ensure that their selection of independent variables aligns with the research question and theoretical framework guiding their study. In the context of the study, the key independent variable is identified,

which is essential for analyzing its impact on the dependent variables. This variable is:

- **Technological Assets Ratio**: This independent variable is measured by the ratio of technological assets to total assets. It assesses the significance of technological investments within a bank's overall asset structure. A higher value of technological assets ratio relative to total assets may indicate a strong reliance on technology for operational efficiency and competitive advantage. As businesses increasingly integrate technology into their operations, understanding the contribution of technological assets is vital. This variable helps to evaluate how technology investments influence performance metrics such as efficiency, innovation, and market competitiveness. By assessing the proportion of technological assets relative to total assets, organizations can identify the extent to which technology enhances their operational capabilities. Research indicates that companies with higher investments in technological assets tend to exhibit improved productivity and competitiveness, making this variable essential for strategic decision-making ***(Melville et al., 2004)***.

  Technological assets refer to any resources or investments a company makes to strengthen its technological capabilities. For banks, these assets encompass a wide range of elements, including software systems like core banking platforms, mobile banking applications, and data management systems. They also include cloud infrastructure, such as cloud computing and storage solutions, as well as digital platforms that support customer-facing services like online banking, payments, and lending. Additionally, technological assets extend to IT hardware (e.g., servers and networking equipment), proprietary technologies (such as blockchain), patents, and research and development (R&D) investments aimed at fostering innovation and technological advancements ***(Kumar & Ayedee, 2021)***.

  Research has shown that companies with a higher proportion of technological assets tend to perform better in terms of productivity and innovation, as they can leverage technology to improve processes and service delivery ***(Soon et al., 2023; Zeng et al., 2010)***.

- **Dependent Variables (Responses)**

  The key dependent variables are identified, in this study, the researcher utilized four dependent variables: two to assess the financial performance of banks and the other two to evaluate banks' comparativeness. These variables are:

  - **Cost-to-Income Ratio:** This dependent variable is calculated by dividing operating expenses by operating income. The cost-to-income ratio serves as a measure of operational efficiency, indicating the proportion of income consumed by expenses. A lower ratio suggests better efficiency, as it reflects a smaller portion of income used to cover costs. This ratio is crucial for understanding how effectively a bank manages its operating expenses relative to the income generated. In financial institutions, for instance, a declining cost-to-income ratio is often viewed as a positive indicator of financial health and operational efficiency ***(Bourke, 1989).***

    This variable has been utilized as an indicator of the bank's competitiveness where a favorable Cost-to-Income Ratio (CIR) often indicates strong competitive positioning, enabling institutions to offer more competitive pricing and invest in technology (***PricewaterhouseCoopers, 2020)***. In the banking sector, banks that effectively utilize technology to streamline operations tend to report lower CIRs, giving them a competitive advantage over more traditional financial institutions ***(McKinsey & Company, 2021)***.

  - **Bank Market Share from the Loan Portfolio:** represents the proportion of the total loan market that the bank holds compared to other banks in the same sector. It is typically calculated by dividing the bank's total loans by the total loans in the market. This indicator is a key indicator of competitiveness in the banking sector. A higher loan market share suggests the bank is effectively capturing a larger portion of the lending market, demonstrating its ability to offer competitive loan products and meet customer needs. This measure is particularly significant in a financial landscape influenced by technology, where data analytics, mobile banking, and other digital tools enhance a bank's capacity to provide customized lending solutions, thereby boosting its market share ***(Davis et al., 2020)***. Banks with a larger loan market share are typically

better equipped to manage liquidity risk and maintain long-term stability in a competitive environment.

- **Return on Equity (ROE):** This dependent variable measures a company's profitability in relation to shareholders' equity and is calculated by dividing net profit by total equity. ROE is a critical indicator of financial performance, reflecting the efficiency with which a company generates profit from its equity investments. A higher ROE indicates that the company is effectively utilizing its equity base to generate earnings, making it a key metric for investors assessing the attractiveness of their investments. It is particularly significant for evaluating management performance and shareholder value ***(Fama & French, 1996)***.

- **Net Interest Margin (NIM)**: is a vital financial metric used to assess a bank's profitability in relation to its core lending activities. And is calculated by subtracting interest expenses from interest income to arrive at the net interest income and dividing this figure by the average interest-earning assets multiplying the result by 100 to express it as a percentage.

  A higher NIM ratio indicates that a bank is effectively managing its interest-earning assets and liabilities, generating more income in comparison to its funding costs. This ratio serves as a critical indicator of a bank's profitability and operational efficiency. By reflecting on how well a bank manages the spread between the interest it earns and the interest it pays out, NIM offers valuable insights into the institution's overall financial health and performance. Furthermore, it allows for meaningful comparisons between different banks or for evaluating a single bank's performance over time. A declining NIM may signal that a bank's interest income is decreasing relative to its expenses, which could be attributed to adverse market conditions or operational inefficiencies ***(Davis et al., 2020)***.

- **Control Variables**

  Incorporating control variables such as GDP growth, Inflation Rate, and Bank Size as control variables, a study can accurately assess how FinTech investments such as technological assets ratio impact key performance

indicators like Return on Equity (ROE) and Net Interest Margin (NIM). And how to impact competitiveness indicators like Cost-to-Income Ratio (CIR) and Bank Market Share from the Loan Portfolio. This helps avoid misleading conclusions where economic conditions or the natural advantages of larger banks skew the results. ***Omankhanlen et al. (2021)*** recommended controlling for macroeconomic factors like GDP and inflation when evaluating the financial sector's performance to isolate the specific impact of technological changes.

Utilizing control variables such as GDP growth, Inflation, and Bank Size in a study on FinTech's adoption impact on bank competitiveness and financial performance is consistent with established research practices. These controls provide a more reliable and valid assessment by distinguishing the real contribution of FinTech adoption from broader economic and internal bank factors. This approach aligns with studies like ***Beck et al. (2000), Perry (1992), and Demirgüç-Kunt and Huizinga (1999)***, and gives a clearer understanding of how technological innovations, such as FinTech, drive performance improvements in banks.

- **GDP growth ratio** has been used as a control variable in numerous studies investigating financial institution performance. For example, ***Beck et al. (2000)*** highlighted the positive relationship between GDP growth and bank profitability, noting that in periods of strong economic performance, banks tend to experience higher demand for their services and loans, leading to better financial outcomes.
- **The inflation rate's** influence on bank performance has been well documented in financial research. ***Perry (1992)*** demonstrated that moderate levels of inflation could lead to higher interest income for banks, improving profitability. However, high inflation rates can increase costs and impair lending, thereby reducing efficiency and profitability. Additionally, inflation often leads to higher interest rates as central banks seek to control rising prices, which can further impact borrowing and lending activities ***(Mishkin, 2007)***. Including inflation

as a control variable allows studies to assess how much of the bank's performance is driven by inflation versus FinTech adoption.

- **The size of a bank**, typically measured as the log of total assets, is a key determinant of its performance. Large banks often benefit from economies of scale and are more capable of making significant investments in technology. ***Demirgüç-Kunt and Huizinga (1999)*** found that larger banks tend to have higher profitability and lower costs, which could also influence how these institutions adopt and benefit from FinTech innovations.

The following Table No. (3.2) outlines the independent, dependent, and controlling variables that can be utilized in such a study.

Table No. (3.2): Study Variables

Variable Type	Variable Name	Variable Equation	Measurement Objective
Independent Variables	Technological Assets Ratio	Bank's Technological Assets / Total Bank Assets	FinTech Adoption Level
Dependent Variables	Cost-to-Income Ratio	Operating Expense / Operating Income	Competitiveness
	Bank Market Share from the Loan Portfolio	Bank's Total Loans / Total Loans in the Market	
	Return on Equity	Net Income / Total Equity	Financial Performance
	Net Interest Margin	Interest Income−Interest Expenses / Average Interest-Earning Assets	
Control Variables	Gross Domestic Product Growth Rate	Given from the World Bank database	Economic Situation
	Inflation Rate	Given from the World Bank database	
	Bank Size	Log of Bank Total Assets	

3.4 Study Analysis Procedures

This study utilized response surface methodology to assess the impact of FinTech adoption on the financial performance and competitiveness of banks operating in Palestine. Design Expert (V.13) software was employed to build the model. Under custom designs, a blank spreadsheet design choice was selected to enter the historical data. The model parameters (independent and control variables) included bank name, year, technology assets ratio, inflation rate, GDP growth, and bank size (log of total assets). The responses (dependent variables) were return on equity, net interest margin, bank market share from the loan portfolio, and cost-to-income ratio. Since the parameters have several data types, the model parameters were classified into numerical and categoric factors. Subsequently, all parameter names, types, the change degree, and the low and the high values were

determined, as shown in Table No. (3.3). Accordingly, a sequence of historical data was recorded (a total of 88 rows were prepared), and Return on Equity (ROE), Net Interest Margin (NIM), Cost-to-Income Ratio (CIR), and Bank Market Share from the Loan Portfolio for each row were entered again into the model, as shown in Appendix No. (1).

Table No. (3.3): Variables and levels considered in the model.

Name	Units	Type	Change	Low value	High value
Bank Name	-	Categoric	Easy	-	-
Years	-	Categoric	Easy	2015	2022
Technological Assets Ratio	%	Numerical	Easy	0.02	3.14
Inflation Rate	%	Numerical	Easy	-0.74	3.74
GDP growth	%	Numerical	Easy	-11.3	8.9
Bank size	$	Numerical	Easy	285,915,663	6,508,221,806

Finally, a second-order quadratic empirical model was developed to assess the impact of FinTech on the financial performance and competitiveness of banks operating in Palestine, as shown in Equation No. (6)

$$Y = \beta_o + \sum_{i=1}^{k} \beta_i X_i \sum_{i=1}^{k} \beta_{ii} X_i^2 + \sum_{i=1}^{k} \sum_{j=1}^{k} \beta_{ij} X_i X_j + \varepsilon \quad (6)$$

Where:

βo is the offset term,

βi is the linear effects of input Xi,

β_{ii} is the quadratic effects of input X_i,

β_{ij} is the linear effect between the input (independent factor) X_i and X_j,

ε is the error.

The mean, linear, 2FI, quadratic, and cubic models were used to judge the data fitting. The model with the highest regression factors was chosen to present the data. Analysis of variance (ANOVA) test was used to assess the predictive ability of the developed model. In general, the ANOVA test shows the following:

- Model row: Illustrates the extent to which the variation in the response (dependent variable) is accounted for by the model, along with an overall test of the model's significance.

- Terms: The model is divided into individual terms, each tested independently.
- Residual: The residual row indicates the amount of variation in the response that remains unexplained.
- Lack of Fit: This refers to the extent to which the model's predictions deviate from the observed values.
- Pure Error: This represents the variation observed between replicate runs.
- Cor Total: This row indicates the total variation around the mean of the observations. The model accounts for a portion of this variation, while the residual accounts for the remainder.
- Sum of Squares: This represents the total of the squared differences between the overall average and the variation explained by each source in that row.
- Degrees of Freedom: This refers to the number of estimated parameters used to calculate the sum of squares for that source.
- Mean Square: This value is obtained by dividing the sum of squares by the degrees of freedom, serving as a measure of variance.
- F Value: This statistic is used to compare the mean square of a source to the mean square of the residuals.
- Prob > F (p-value): This represents the probability of observing the F-value if the null hypothesis is true (indicating no factor effects). Small probability values suggest rejecting the null hypothesis. This probability corresponds to the area under the F-distribution curve that extends beyond the observed F-value.

In this study, the null hypothesis for the ANOVA test was assumed to indicate that no effects from the parameters (independent variable) on the response (dependent variable). The following conditions were established to decide the significant issues:

- For model and model terms: significance is established if the p-value is less than or equal to 0.05.

If the Prob > F value is very small, it indicates that the source is statistically significant. Significant model terms are likely to have a genuine effect on the response. Conversely, a significant lack of fit suggests that the model does not adequately represent the data within the observed variation of the replicates.

For each model, the following statistical analyses were done:

- Std Dev (Root MSE): This is the square root of the Mean Square Error, representing the standard deviation of the residuals.
- Mean: The overall average of all the response data.
- Coefficient of Variation: This is the ratio of the standard deviation to the mean, expressed as a percentage. It measures the relative variability of the data in relation to the mean.
- Predicted Residual Error Sum of Squares (PRESS): This metric quantifies the sum of the squared differences between observed values and their predicted values, focusing on the residual errors. It is often used to assess the predictive accuracy of a model, as shown in Equation No. (7):

$$PRESS = \sum_{i=1}^{n} (e_{-i})^2 \quad (7)$$

Where:

e_{-i} is a deletion residual calculated by fitting a model without the i^{th} run and then using that model to predict the i^{th} observation and can be calculated from

Equation No. (8):

$$e_{-i} = y_i - y^*_{-1} = \frac{e_i}{1-h_{ii}} \quad (8)$$

Where:

e_i is the residual for each observation that remains after fitting the model to all the data.

h_{ii} is the leverage of the run in the design.

- R-squared: This statistic measures the proportion of variance in the dependent variable that can be explained by the independent variables in

the model. It indicates the goodness of fit, with values closer to 1 suggesting a better fit, which can be calculated from Equation No. (9):

$$R^2 = 1 - \frac{SS_{res}}{SS_{total}} \quad (9)$$

Where:

SS_{res} is the sum of squares of the residuals (the variation not explained by the model)

SS_{total} is the total sum of squares (the total variation in the dependent variable).

- Adjusted R-squared: This statistic adjusts the R-squared value for the number of predictors in the model, providing a more accurate measure of goodness of fit. It accounts for the degrees of freedom and penalizes the addition of non-significant predictors. The formula is:

$$Adj\ R^2 = 1 - (\frac{(1-R^2)(n-1)}{n-p-1}) \quad (10)$$

where:

R^2: is the regular R-squared value.

n: is the number of observations.

p: is the number of predictors in the model.

- Predicted R-squared (Pred R^2): This statistic estimates the model's predictive power by evaluating how well it predicts new data.

$$Pred.R^2 = 1 - \left(\frac{PRESS}{SS_{res}+SS_{model}}\right) = 1 - (\frac{PRESS}{SS_{total}-SS_{curvature}+SS_{block}}) \quad (11)$$

- Adequate Precision: This measure assesses the signal-to-noise ratio of a model. It indicates the model's ability to predict responses within a certain range of variability. A value greater than 4 is generally considered adequate, suggesting that the model can reliably guide decision-making.

$$\text{Adequate Precision} = \frac{\text{Range of predicted values}}{\text{Standard deviation of the prediction error}} \quad (12)$$

The statistical analyses were plotted for the model. To understand the model statistical summary, the following figures were presented in the thesis ***(Vining, 2011)***:

- Normality test: the figure shows if the residuals conform to a normal distribution by aligning with a straight line. Some variation is to be expected, even with normally distributed data. This test is an indicator if transformation is required or not. For example, the S-shape point pattern reflects the need for transformation.
- Residuals vs. Predicted: This graph displays the residuals against the increasing predicted response values. It evaluates the assumption of constant variance. Ideally, the points should appear as a random scatter, indicating a consistent range of residuals throughout. Also, this test helped in determination of transformation.
- Predicted vs. Actual: This graph compares the predicted response values to the actual response values. Its aim is to identify any individual values or clusters that the model struggles to predict accurately.
- Residuals vs. Run: This graph displays the residuals against the order of the experimental runs. It helps identify hidden (lurking) variables that might have affected the response during the experiment. Ideally, the points should appear as a random scatter. Any noticeable trends could suggest a time-related factor at play. Implementing blocking and randomization helps in protection against these trends compromising the analysis.
- Residuals vs. Factor: This graph shows the residuals in relation to a selected factor. It assesses whether the unexplained variance varies across different levels of that factor. Ideally, the plot should display a random scatter. If there's noticeable curvature, it may suggest a systematic influence from the independent factor that the model has not captured.

3.5 Study Econometrics Models

This section outlines the econometric models applied in the study to analyze the relationship between Bank FinTech adoption level and Bank Competitiveness and Performance within the Palestinian banking sector. These models help quantify the impact of technological assets on competitiveness and financial performance, using key metrics such as the Bank Technological Assets Ratio, Bank Cost to Income Ratio, Bank Loan Market Share Ratio, Return on Equity Ratio, and Net Interest Margin Ratio. By applying response surface methodology and other econometric techniques, the study aims to identify significant patterns and relationships, offering insights into how FinTech influences operational efficiency, market share, and profitability across the sector.

$$CIR = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (13)$$

$$LMS = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (14)$$

$$ROE = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (15)$$

$$NIM = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (16)$$

Where:

TAE: Technological Assets Ratio

CIR: Cost to Income Ratio,

LMS: Loan Market Share Ratio,

ROE: Return on Equity Ratio,

NIM: Net Interest Margin Ratio

βo is the offset term,

βi is the linear effects of input TARi,

βii is the quadratic effects of input TARi,

βij is the linear effect between the input (independent factor) TARi and CVj,

ε is the error.

CV is the control variable.

Chapter 4: Study Results

4.1 Introduction

This chapter presents the analysis of data and findings of the study, directing on the impact of FinTech adoption on the competitiveness and financial performance of banks operating in Palestine. The results are structured to address the research questions, objectives, and test the hypotheses outlined earlier, offering insights into the significance and nature of these relationships.

The first section of this chapter focuses on descriptive analysis, providing an overview of the data used in the study. This analysis highlights the characteristics and distribution of key variables, offering valuable insights into the underlying patterns and trends. By examining the central tendencies, variability, and relationships among variables, this section lays a foundational understanding of the dataset. Such an understanding is critical for ensuring the robustness of subsequent inferential tests, which aim to address the study's research questions and hypotheses.

The second part of the first section includes the data analysis assumption, the researcher will conduct several diagnostic tests to ensure the reliability and validity of the analysis. A normality test will be performed to assess whether the residuals of the model follow a normal distribution, which is essential for valid hypothesis testing and accurate confidence intervals ***(Gujarati & Porter, 2009)***. A homoscedasticity test will be conducted to determine if the variance of residuals remains constant across all levels of the independent variables, as this is crucial to avoid biased standard errors and unreliable p-values ***(Wooldridge, 2020)***. Additionally, an autocorrelation test will check whether the residuals are independent of each other, especially in time series data, ensuring efficient estimates and valid inferences ***(Durbin & Watson, 1951)***. Lastly, a linearity test using scatter plots enables researchers to assess whether the data is appropriate for linear regression or if alternative methods are needed.

These tests are critical to verifying that the model assumptions are met, enhancing the accuracy and credibility of the study's findings.in addition, this section identifies the producers and outlines the steps the researcher followed in the data analysis process.

The second section explores the relationship between FinTech adoption, as measured by the Technological Assets Ratio, and bank competitiveness, assessed through the Cost-to-Income Ratio and Loan Market Share. And examines the impact of FinTech adoption on the financial performance of banks, specifically its influence on the Return on Equity (ROE) and Net Interest Margin (NIM) ratios. Additionally, this section tests the study's hypotheses. The final section summarizes the key findings.

The analysis relies on secondary data sourced from the financial statements and reports of sample banks, as well as databases from the World Bank. The bank financial statements offer detailed insights into the banks' financial performance and competitiveness metrics as well as the FinTech level adapted by each bank. Meanwhile, The World Bank data includes key economic indicators, such as GDP growth and inflation rates, providing valuable contextual information for the study. Response Surface Methodology (RSM) was utilized to test and validate the hypotheses using Design Expert (V.13) software. This chapter also identifies notable trends, correlations, and deviations observed in the data, establishing a foundation for an in-depth discussion and interpretation of the results in the subsequent chapter.

By systematically presenting these findings, this chapter aims to contribute to a deeper understanding of how FinTech adoption influences the competitiveness and financial dimensions of banking in Palestine.

4.2 Descriptive Analysis

The descriptive analysis establishes a foundation for understanding the dynamics of FinTech adoption and its implications for banks operating in Palestine. These insights provide context for the inferential analyses presented in the subsequent sections, which further explore the relationships between FinTech adoption, competitiveness, and financial performance.

At the conclusion of data collection, the study sample consisted of 11 banks out of the 13 banks operating in Palestine as of the end of 2022. Two banks were excluded due to incomplete essential data or insufficient disclosures relevant to the study requirements. This selection criterion ensured that the sample included only banks with comprehensive and accessible financial records, facilitating a robust analysis of the impact of FinTech innovations on their competitiveness and financial performance. Consequently, the final sample includes 5 local Palestinian banks and 6 foreign banks operating in Palestine, covering the period from 2015 to 2022. The names of the banks and their nationality in the final sample are presented in Table No. (4.1) below.

Table No. (4.1) Names and Nationality of Final Sample Banks

#	Bank name	Nationality	#	Bank name	Nationality
1	Bank of Palestine	Palestinian	7	Cairo Amman Bank	Jordanian
2	Arab Islamic Bank	Palestinian	8	Bank of Jordan	Jordanian
3	Palestine Islamic Bank	Palestinian	9	The Housing Bank for Trade & Finance	Jordanian
4	Quds Bank	Palestinian	10	Jordan Ahli Bank	Jordanian
5	The National Bank	Palestinian	11	Arab Bank	Jordanian
6	Palestine Investment Bank	Palestinian			

Table No. (4.2) below summarizes the descriptive analysis of the key variables used in this study, providing an overview of their distribution, central tendencies, variability, and shape. These statistics help in understanding the data before proceeding to inferential analysis.

Table No. (4.2): Descriptive Statistics

Variables / Value	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error

TAR (%)	88	3.13	0.02	3.14	0.7261	0.81033	0.657	1.484	0.257	1.074	0.508
CIR (%)	88	44	42	85	66.03	8.729	76.2	-0.292	0.257	-0.096	0.508
LMS (%)	88	29.97	2.01	31.97	9.0909	8.39018	70.395	1.592	0.257	1.495	0.508
ROE (%)	88	24.30	-3.90	20.40	8.3866	4.71882	22.267	0.163	0.257	0.451	0.508
NIM (%)	88	10.94	0.53	11.48	6.4143	1.73715	3.018	0.027	0.257	2.125	0.508
Inflation Rate (%)	88	4.48	-.74	3.74	0.8817	1.35529	1.837	0.874	0.257	-0.012	0.508
GDP Growth (%)	88	20.20	-11.30	8.90	2.0500	5.71300	32.638	-1.335	0.257	1.293	0.508

Where: TAR (Technological Assets Ratio), CIR (Cost-to-Income Ratio), LMS (Loan Market Share), ROE (Return on Equity), and NIM (Net Interest Margin).

❖ Independent Variable

- **Technological Assets Ratio (TAR)**: The mean of the TAR is 0.73%, which is relatively small but consistent with findings from similar studies. The standard deviation of 0.81% highlights notable variability across the sample. TAR, representing the FinTech adoption level, exhibits a range of 3.13%, with actual values spanning from 0.02% to 3.14%. The skewness value of 1.484 indicates a positively skewed distribution ***(Gujarati & Porter, 2009)***, meaning that most banks have lower TAR values, with a few banks having significantly higher values. Additionally, the kurtosis value of 1.074 reflects a distribution with slightly heavier tails than a normal distribution ***(DeCarlo, 1997)***, which suggests the presence of outliers or extreme values in the data**.**

❖ Dependent Variables

- **Cost-to-Income Ratio (CIR):** The mean of CIR is 66%, while the standard deviation is 8.73%, indicating that most banks exhibit similar levels of operational efficiency. CIR ranges from 42% to 85%. The skewness value of -0.292 suggests a slight left skew in the distribution, implying that a small number of banks have lower efficiency ratios compared to the mean. Additionally, the kurtosis value of -0.096 indicates a distribution close to normal, reflecting minimal deviation from the expected bell-shaped curve ***(Gujarati & Porter, 2009; DeCarlo, 1997)***.
- **Loan Market Share (LMS):** The mean of LMS is 9.09%, while the standard deviation of 8.39% highlights substantial variability in the

competitive positioning of banks. Exhibits the widest range among the variables at 29.97%, with values spanning from 2.01% to 31.97%. The skewness value of 1.592 reflects a positive skew, indicating that a small number of banks dominate the loan market. Additionally, the kurtosis value of 1.495 suggests a distribution with heavier tails than a normal distribution, indicating the presence of outliers or extreme values ***(Gujarati & Porter, 2009; DeCarlo, 1997)***.

- **Return on Equity (ROE):** The mean of ROE is 8.39%. while the standard deviation of 4.72% reflects moderate variability in profitability among banks**.** Ranges from -3.90% to 20.40%, The skewness value of 0.163 suggests a nearly symmetrical distribution, indicating a balanced spread of values around the mean. Additionally, the kurtosis value of 0.451 indicates that the data is slightly flatter than a normal distribution, implying fewer extreme values or outliers compared to a typical bell-shaped curve (***Gujarati & Porter, 2009; DeCarlo, 1997)***.
- **Net Interest Margin (NIM):** The mean of NIM is 6.41%. while the standard deviation of 1.74% reflects some variability. NIM has a wide range from 0.53% to 11.48%. The skewness value of 0.027 suggests a nearly symmetrical distribution, indicating that the data is evenly distributed around the mean. However, the kurtosis value of 2.125.

❖ **Control Variables**

- **Inflation Rate**: Has a mean of 0.88% and a standard deviation of 1.355%, indicating moderate variability. The range spans 4.48%, with values ranging from -0.74% to 3.74%. The skewness value of 0.874 suggests a moderately positive skew, indicating that higher inflation rates are more frequent. Additionally, the kurtosis value of -0.012 indicates a distribution that is nearly normal, with only a slight deviation from the typical bell-shaped curve (***Gujarati & Porter, 2009; DeCarlo, 1997)***.
- **GDP Growth:** Has a mean of 2.05% and a standard deviation of 5.71%, reflecting considerable variability. The range spans 20.20%, with values ranging from -11.3% to 8.9%. The skewness value of -1.335 indicates a negatively skewed distribution, suggesting that lower GDP growth values are more common. Additionally, the kurtosis value of 1.293 indicates a

distribution with slightly heavier tails than a normal distribution, implying the presence of some extreme values or outliers (***Gujarati & Porter, 2009; DeCarlo, 1997)***.

4.3 Analysis Assumptions and Procedures

4.3.1 Data Analysis Assumptions

To ensure the reliability and validity of the analysis the researcher conducted several diagnostic tests as follows:

- **Normality**: Ideally, both the independent and dependent variables should follow a normal distribution. The researcher identified outliers that significantly impact the normality assumption for both the Bank of Palestine and the Arab Bank. Various methods can be employed to address this issue, such as removing the outliers, transforming the data, or applying robust statistical techniques that are less sensitive to the influence of outliers.

  The Kolmogorov-Smirnov test was used to assess the normality of the study variables, as the sample size of 88 exceeds 50, making the Shapiro-Wilk test unsuitable ***(Razali & Wah, 2011)***. the researcher conducted the Kolmogorov-Smirnov test to determine the normality of the study variables as illustrated in Table No. (4.3). variables with p-values greater than 0.05 were found to follow a normal distribution. Specifically, CIR, ROE, and NIM exhibited normal distribution. However, the other variables had p-values lower than 0.05, indicating that these variables do not follow a normal distribution, prompting the need to transform certain variables for proper analysis.

Table No. (4.3): Tests of Normality (Kolmogorov-Smirnova)

	Statistic	df	P Value	Status
TAR	0.293	88	0.000	Not Normal
CIR	0.068	88	0.200*	Normal
LMS	0.276	88	0.000	Not Normal
ROE	0.062	88	0.200*	Normal
NIM	0.086	88	0.146	Normal
Inflation Rate	0.189	88	0.000	Not Normal
Bank Size	0.258	88	0.000	Not Normal
GDP Growth	0.316	88	0.000	Not Normal

**. This is a lower bound of the true significance.*

a. Lilliefors Significance Correction

Where: TAR (Technological Assets Ratio), CIR (Cost-to-Income Ratio), LMS (Loan Market Share), ROE (Return on Equity), and NIM (Net Interest Margin).

- **Linearity**: To assess the linearity assumption in data analysis, the researcher employed a scatter plot to visually examine the relationship between the independent and dependent variables. As illustrated in Figures No. (4.1-4), the scatter plot revealed a non-linear relationship, evident from the random patterns of the data points. This observation indicated that the linearity assumption, a fundamental requirement for simple linear regression models, was not satisfied. Acknowledging the non-linear nature of the data, the researcher adopted Response Surface Methodology (RSM) as the analytical approach. RSM is particularly effective for modeling and analyzing non-linear relationships, as it utilizes polynomial regression models to approximate the response surface. This methodology provides a more flexible and accurate representation of the underlying relationships between variables, offering significant advantages over traditional linear models in capturing complex patterns and interactions.

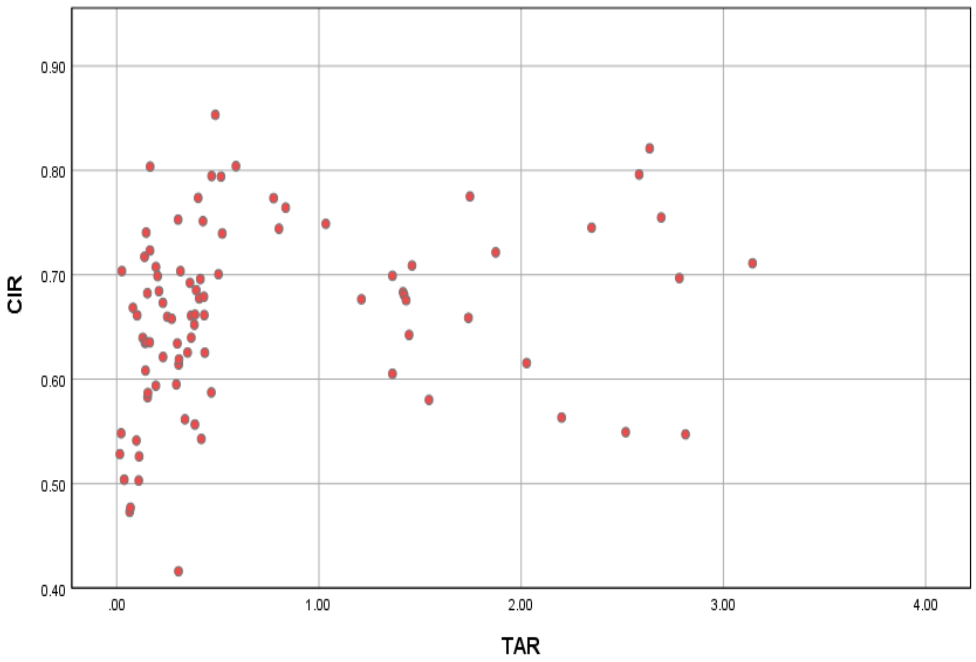

Figure No (4.1): Scatter Plot of TAR and CIR

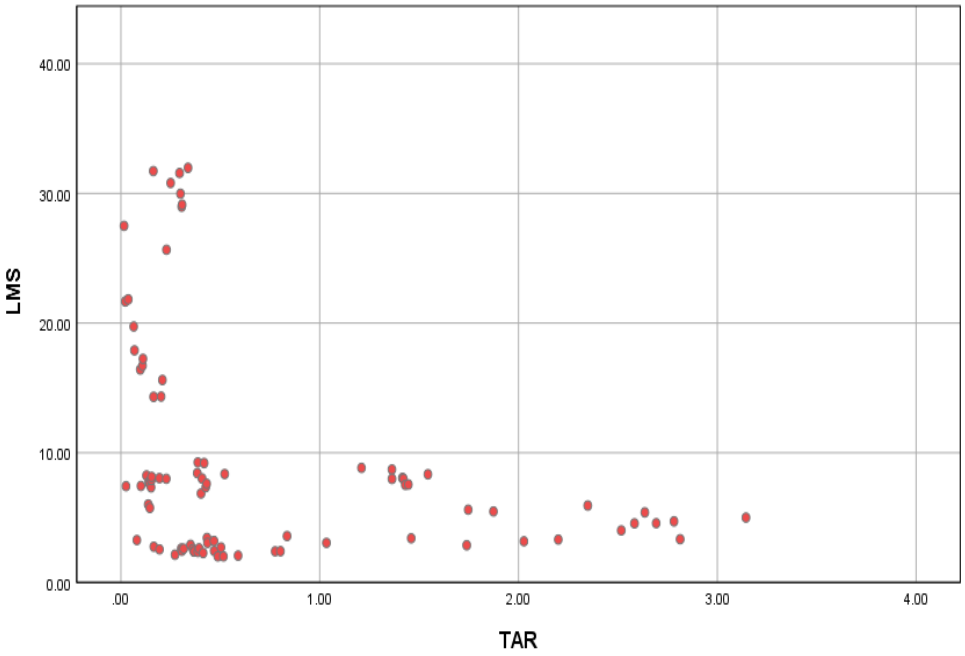

Figure No (4.2): Scatter Plot of TAR and LMS

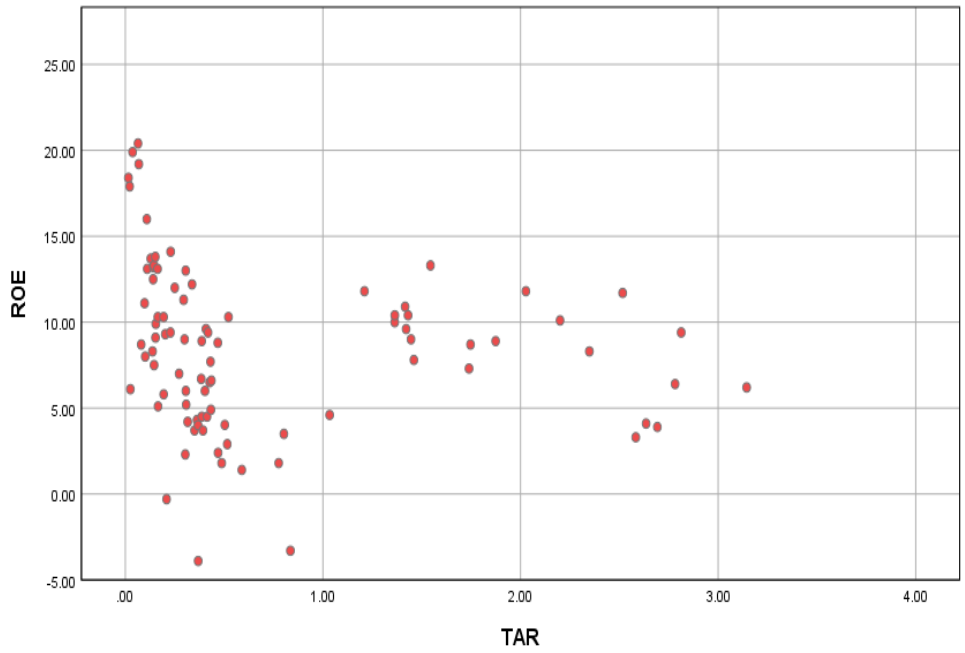

Figure No (4.3): Scatter Plot of TAR and ROE

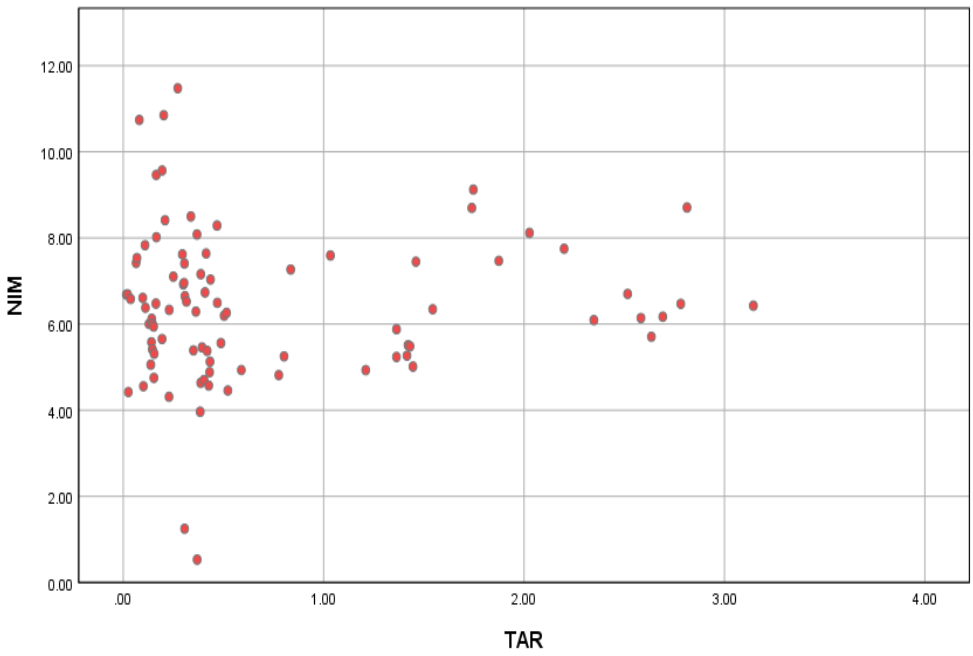

Figure No (4.4): Scatter Plot of TAR and NIM

- **Homoscedasticity:** To determine whether the data is homogenous, the Breusch-Pagan/Cook-Weisberg Test for Heteroscedasticity was conducted for each developed model ***(Breusch & Pagan, 1979; Cook & Weisberg, 1983)***. For each valid model, the regression was done, and the residual values were calculated at each run. Then, the squared residuals of the model were calculated, and a new regression model using the squared residuals as the response values was generated. The chi-square was determined by multiplying the R-squared of the new regression model with the observation number as shown in Equation No. (17).

$$X^2 = n * R^2_{new} \quad (17)$$

Where:

X^2: The chi-square

R^2: R-squared of the new regression model

If the p-value for the determined X^2 is less than the significant level (0.05), suggesting that the data is heterogeneous. The results of this test are presented under each model in the following sections.

- **Autocorrelation:** The Durbin-Watson Test was used to judge if the error terms were independent or not ***(Durbin & Watson, 1950)***. To achieve this test, the residuals were generated from each model. Then the sum of the squared residual difference was divided by the sum of squared residuals, as shown in Equation No. (18).

$$D = \frac{\sum_{t=2}^{n}(\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=1}^{n}\varepsilon_t^2} \quad (18)$$

Where:

ε_t*: (Actual-predicted values) are the residuals from the ordinary least squares fit.*

The calculated D was compared with the lower (DL) and the upper (DU) values presented in the Durbin-Watson Tables. Based on that, the data can be concluded as follows:

- If D >DU: Accept the null hypothesis and there is no significant autocorrelation for the data.
- If D<Dl: Accept the null hypothesis and there is no autocorrelation for the data.
- If DL<D<DU: The test is inconclusive.
- The results of this test are presented under each model.

The results of this test are presented under each model in the following sections.

4.3.2 Data Analysis Procedures and Steps

This section summarizes the procedures that the researcher followed in analyzing the data. First, the researcher assessed the data for normal distribution. If the data did not exhibit normality, appropriate transformations were applied using statistical software to achieve a normal distribution. After ensuring normality, the researcher analyzed the data using Response Surface Methodology (RSM) by testing various modeling approaches, including linear, two-factor interaction (2FI), quadratic, and cubic models, to determine the best-fitting model.

After selecting the best-fitting model, the researcher conducted an Analysis of Variance (ANOVA) test to evaluate its performance and reliability. ANOVA is a statistical method used to analyze the differences between group means and assess the overall significance of a model. It determines whether the variation in the dependent variable can be explained by the independent variables included in the model ***(Field, 2018)***.

Then, the researcher tested the hypotheses based on the ANOVA results. ANOVA compares within-group variability (the variation within individual groups) to between-group variability (the variation between the means of different groups). This comparison provides a statistical foundation for determining whether the observed differences are statistically significant, helping to confirm or refute the hypotheses under investigation ***(Field, 2018)***.

When an important relationship between variables is identified, the researcher evaluates the model's predictive capability. This is done by examining the Adequate Precision value; a value exceeding the recommended threshold of 4 confirms the model's ability to effectively navigate the design space and generate reliable predictions ***(Montgomery et al., 2021)***. Additionally, a difference of less than 0.2 between the adjusted R^2 and predicted R^2 values indicates that the model is sufficiently precise for describing the working space ***(Neter et al., 1996)***. Once a suitable model is established, the researcher utilizes statistical software to formulate and document the expected model, which can then be applied to predict future patterns in the data.

Finally, the researcher will conduct the Homoscedasticity and Autocorrelation tests when an important relationship between variables is identified.

Response Surface Methodology (RSM) encompasses key types of models commonly used to explore the relationship between independent variables (factors) and a dependent variable (response). Below is an explanation of the primary models utilized in this study:

- **Linear models** are the simplest form, assuming a direct and proportional relationship between the predictors and the response variable. These models are suitable when there is no significant interaction or curvature in the data. By focusing solely on the main effects of the independent variables, linear models provide a straightforward approach for initial analysis and interpretation. However, they may fail to capture complex relationships where interactions or nonlinearity play a significant role ***(Montgomery, 2021).*** It assumes that the response changes consistently and linearly with changes in the predictors. This model does not account for interactions or curvature in the relationships. It is widely used for its simplicity and computational efficiency, making it ideal for datasets where relationships between variables are straightforward. However, it cannot capture more complex dynamics, such as variable interactions or non-linear patterns.

- **Two-factor interaction (2FI) models** build on linear models by incorporating interaction terms that reflect the combined effect of two independent variables on the response. These terms help to reveal interdependencies that are not evident when the variables are considered individually. Such models are particularly valuable in scenarios where understanding the synergy or antagonism between factors is crucial, as they offer insights into how variables jointly influence the outcome. For example, in banking studies, interactions between technological assets and operational costs could be analyzed using a 2FI model to identify combined effects on competitiveness **(*Myers et al., 2016).***

  The two-factor interaction model extends the linear model by including terms that capture the interaction effects between pairs of independent variables. Interaction terms reflect how the combined influence of two

factors on the response variable differs from their individual contributions. This model is particularly useful when there is evidence that the relationship between predictors and the response is enhanced or altered when the predictors act together. While the 2FI model provides more flexibility than a purely linear model, it does not account for higher-order interactions or non-linear trends.

- **Quadratic models** provide a more advanced approach by including both squared terms of the independent variables and interaction terms. These models are especially useful when the data exhibits curvature, as they allow for a more flexible representation of the relationship between variables. Quadratic models are commonly used for optimization problems, where identifying the peak or trough of a response surface is the primary objective. For instance, in the context of banking, a quadratic model could be used to optimize the balance between technological investment and loan portfolio performance, accounting for nonlinear effects ***(Myers et al., 2016)***. The quadratic model builds upon the linear and 2FI models by including squared terms for the independent variables. These terms allow the model to account for curvature in the relationship between predictors and the response variable. A quadratic model is suitable for situations where the response exhibits a curved or parabolic pattern as the predictors change. This makes it more adaptable to non-linear relationships. However, it is more complex than linear and 2FI models, and there is a higher risk of overfitting, especially when working with limited datasets.
- **Cubic models** are advanced polynomial models used to analyze complex relationships between input variables (factors) and an output variable (response). These models include higher-order terms, such as cubic and cross-product terms, which allow for the modeling of intricate non-linear patterns that quadratic models cannot capture. Cubic models are particularly useful when the response surface exhibits significant curvature or complex interactions, providing greater flexibility in fitting experimental data ***(Montgomery, 2021)***. The cubic model takes flexibility even further by incorporating cubic terms for the independent variables. These terms enable the model to capture more complex, non-linear relationships that

quadratic models cannot adequately represent. The cubic model is particularly useful in situations where the response variable displays intricate patterns of variation in relation to the predictors. However, this increased flexibility comes at a cost: the model becomes more prone to overfitting and may require careful validation to ensure it generalizes well to new data.

4.4 Testing of Hypotheses

4.4.1 Effect of Technological Assets Ratio on the Cost-to-Income Ratio

The effects of the Technological Asset Ratio (TAR), serving as an indicator of a bank's FinTech adoption level, on the Cost-to-Income Ratio (CIR), representing the first measure of bank competitiveness, was analyzed using Response Surface Methodology (RSM). As confirmed by the normality test discussed earlier, the CIR variable follows a normal distribution, so there is no need to conduct any transformation methods. While the TAR variable does not follow a normal distribution, the researcher explored various transformation methods. Ultimately, the power with a lambda value of 2 transformations was selected for its suitability. Subsequently, the researcher conducted the Kolmogorov-Smirnov test again on the transformed TAR data to assess normality, the results showed p-values (0.172) greater than 0.05, indicating that the transformed data for TAR followed a normal distribution.

The resulting model, developed to assess the impact of the Technological Assets Ratio (TAR) on the Cost-to-Income Ratio (CIR) within the Palestinian banking sector from 2015 to 2022, is based on Equation No. (13) that was previously presented in Chapter Three.

$$CIR = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (13)$$

The data was then fitted to several models including, linear, 2FI, quadratic, and cubic models. Table No. (4.4) provides a comparative analysis of four regression models—linear, 2FI, quadratic, and cubic—using sequential p-values, adjusted R^2, and predicted R^2 as evaluation metrics. The linear model shows a highly significant sequential p-value (< 0.0001), suggesting a good initial fit. However, its adjusted R^2 (0.3210) and predicted R^2 (0.2555) are relatively low, indicating limited explanatory and predictive capability. While the linear model captures basic trends in the data, it may not adequately represent complex relationships.

The 2FI model has a sequential p-value of 0.0811, which is not statistically significant at the 0.05 threshold. Although its adjusted R^2 (0.3653) is slightly

higher than that of the linear model, its predicted R^2 (0.2194) is lower, reflecting poor predictive performance. These results suggest that the 2FI model does not substantially improve upon the linear model in capturing variability in the data or predicting new observations.

The quadratic model shows a sequential p-value of 0.1174, which is also not statistically significant. Despite this, it offers a slightly higher adjusted R^2 (0.3940) compared to the linear and 2FI models, indicating a modest improvement in explanatory power. However, its predicted R^2 (0.2342) remains relatively low, suggesting that the quadratic model does not substantially enhance predictive accuracy over simpler models.

The cubic model, in contrast, emerges as the most robust option. It has a sequential p-value of 0.0494, meeting the threshold for statistical significance. Additionally, it achieves the highest adjusted R^2 (0.4764) and predicted R^2 (0.4132) among all models. These metrics indicate that the cubic model offers superior explanatory and predictive capabilities, making it the most suitable for analyzing and predicting the effects of the variables in question.

In conclusion, while the linear, 2FI, and quadratic models show varying degrees of adequacy, the cubic model is recommended due to its balance of statistical significance, higher adjusted R^2, and predictive accuracy. This model provides the most reliable insights into the underlying relationships among the variables, based on that the researcher will employ a cubic model, a form of polynomial regression that incorporates model terms up to the third degree, and will test the interaction between model terms to effectively capture complex non-linear relationships within the data.

Table No. (4.4): Statistical Data Fitting Results for CIR and TAR Model

Source	Sequential p-value	Adjusted R^2	Predicted R^2	Note
Linear	< 0.0001	0.3210	0.2555	
2FI	0.0811	0.3653	0.2194	
Quadratic	0.1174	0.3940	0.2342	
Cubic	0.0494	0.4764	0.4132	Suggested

To determine the significance of the model and its terms, an ANOVA test was conducted. The results, summarized in Table No. (4.5), assess the CIR and TAR model, The ANOVA results for the regression model assessing the effects of

various predictors and interactions on the response variable indicate that the overall model is highly significant, with a p-value of < 0.0001 and an F-value of 9.80. This suggests a strong fit to the data. Among the main predictors, TAR (p-value < 0.0001), Bank size (p-value < 0.0001), and GDP Growth (p-value = 0.0095) are statistically significant, indicating they have a meaningful impact on the response variable. In contrast, the Inflation rate (p-value = 0.2530) is not significant, suggesting that it does not play a significant role in the model.

Several model interaction terms are also significant, including TAR*Inflation rate (p-value = 0.0056) and Inflation rate*GDP Growth (p-value = 0.0029), indicating that interactions between these variables affect the outcome. Additionally, the quadratic term for TAR^2 (p-value = 0.0271) and the cubic term for TAR^3 (p-value < 0.0001) are significant, suggesting that non-linear relationships between TAR and the response variable contribute to the model's accuracy. The interaction term TAR^2*Inflation rate has a p-value of 0.0770, which is marginally above the typical 0.05 significance threshold, indicating a weaker effect. The residual sum of squares is 0.3112, reflecting the variability not explained by the model.

In conclusion, the significant predictors in this model demonstrate their substantial influence on the response variable. The model's overall significance and the importance of the non-linear and interaction terms highlight its robustness in explaining the data.

Table No. (4.5): ANOVA for Response Surface Cubic - CIR and TAR Model

Source	Sum of Squares	df	Mean Square	β -value	F-value	p-value	Status
Model	0.3517	9	0.0391	+0.644205	9.80	< 0.0001	Significant
TAR	0.0725	1	0.0725	+39.21890	18.16	< 0.0001	Significant
Inflation rate	0.0053	1	0.0053	+0.426724	1.33	0.2530	-
Bank size	0.0825	1	0.0825	-2.29684E-11	20.67	< 0.0001	Significant
GDP Growth	0.0282	1	0.0282	-0.186187	7.08	0.0095	Significant
TAR*Inflation rate	0.0324	1	0.0324	+277.47307	8.13	0.0056	Significant
Inflation rate*GDP Growth	0.0377	1	0.0377	-71.10248	9.45	0.0029	Significant
TAR^2	0.0202	1	0.0202	-3612.53056	5.07	0.0271	Significant
TAR^2*Inflation rate	0.0128	1	0.0128	-15285.13910	3.21	0.0770	-
TAR^3	0.0951	1	0.0951	+88781.58951	23.84	< 0.0001	Significant
Residual	0.3112	78	0.0040	-			
Cor Total	0.6629	87		-			

Where: TAR (Technological Assets Ratio), CIR (Cost-to-Income Ratio).

In this study, the null hypothesis for the ANOVA test posits that the parameters (independent variables) have no significant effect on the response (dependent variable). Statistical significance was determined using a criterion where a p-value less than or equal to 0.05 for the model and its terms indicate a significant effect ***(Field, 2018)***. So based on these findings, the researcher accepts the first hypothesis, $H_{1.1}$, which states that the ***Technological Asset Ratio (TAR) significantly enhances the Cost-to-Income Ratio (CIR) of banks in Palestine***. This conclusion is supported by the significant p-value for the model (< 0.0001), and the significant p-value for the model term (TAR) (< 0.0001) in the ANOVA results, indicating its strong influence on the response variable. Additionally, the significant impact of TAR^2 and TAR^3 further reinforces the hypothesis, demonstrating that not only the linear but also the non-linear effects of TAR are crucial in explaining variations in the cost-to-income ratio of banks. This relationship was particularly evident in the Bank of Palestine, whereas it was less pronounced in the Jordan Ahli Bank.

Table No. (4.6) illustrated that the regression model demonstrates a mean value of 0.6603 for the response variable, with a standard deviation of 0.0632, indicating moderate variability in the data. The model's R^2 value of 0.5306 suggests that 53.06% of the variation in the response variable is explained by the predictors included in the model. The Adjusted R^2, at 0.4764, accounts for the number of predictors and degrees of freedom, indicating slightly reduced explanatory power, as noted in standard regression analysis practices ***(Kutner et al., 2005)***. The Predicted R^2 value of 0.4132 highlights the model's ability to predict new observations with reasonable accuracy, aligning with guidelines for assessing predictive models ***(Montgomery et al., 2021)***.

The coefficient of variation (CV) is 9.57%, showing that the variability in the response variable relative to the mean is low, which supports a reliable model fit. The model's PRESS value (Prediction Error Sum of Squares) is 0.3890, further substantiating its predictive validity ***(Draper & Smith, 1998)***. Additionally, the Adequate Precision value of 13.94707, which exceeds the recommended threshold of 4, confirms the model's capability to effectively navigate the design

space and generate reliable predictions ***(Montgomery et al., 2021)***. the difference between R^2adjusted and R^2predicted is less than 0.2, indicating that the model is adequately precise for describing the working space ***(Neter et al., 1996).***

Table No. (4.6): Statistical Results for CIR and TAR Model

Statistical	Results	Statistical	Results
Mean	0.6603	R^2	0.5306
Standard deviation	0.0632	Adjusted R^2	0.4764
Coefficient of variation (%)	9.57	Predicted R^2	0.4132
PRESS	0.3890	Adequate Precision	13.94707

The regression model demonstrates moderate robustness, with strong predictive precision and sufficient explanatory power to evaluate the effects of the Technological Assets Ratio (TAR) on the Cost-to-Income Ratio (CIR). This significance ensures the model's reliability for understanding and forecasting how changes in TAR influence CIR. The relationship between TAR and CIR can be quantified and analyzed using the equation No. (19), derived from the regression model illustrated in Table No. (4.5):

$$\text{CIR} = 0.644205 + 39.21890\ \text{TAR} + 0.426724\ \text{Inflation rate} - 2.29684 * 10^{-11}\ \text{Bank size} - 0.186187\ \text{GDP} + (277.47307\ \text{TAR} * \text{Inflation rate}) - 3{,}612.53056\ \text{TAR}^2 - (15{,}285.13910\ \text{TAR}^2 * \text{Inflation rate} + 88{,}781.58951\ \text{TAR}^3 \quad (19)$$ *

**Since this equation is derived from the cubic model, some variables are raised to the power of two or three, and it also includes terms that capture the interaction effects between pairs of independent variables.*

The residuals from the model were used to assess homoscedasticity using the Breusch-Pagan/Cook-Weisberg test and autocorrelation using the Durbin-Watson test. The results indicated that the effect of the Technological Assets Ratio (TAR) on the Cost-to-Income Ratio (CIR) model satisfies the assumption of homoscedasticity at a significant level of 0.05, with no evidence of autocorrelation in the data, as shown in Table No. (4.7).

Table No. (4.7): Breusch-Pagan and Durbin-Watson Test Results for CIR and TAR Model

Breusch-Pagan		Durbin-Watson	
Multiple R	0.2015	Calculated D	1.13537
R Square: rbp^2	0.0406	DU	1.4358
Observation	88	DL	1.883
$X^2calc = n*rbp^2$	3.574	D<DL: Accept the null hypothesis and conclude no autocorrelation for the data	
K	9		
X Table	18.307		

P-value >0.05: Accept the null hypothesis and conclude Homoscedasticity of the model.	

4.4.2 Effect of Technological Assets Ratio on the Bank Market Share from the Loan Portfolio

The impact of the Technological Asset Ratio (TAR) on a bank's market share within the loan portfolio (LMS), as the second measure of bank competitiveness, was analyzed using Response Surface Methodology (RSM). Since the LMS variable did not follow a normal distribution, as confirmed by the normality test discussed earlier, the researcher explored various transformation methods. Ultimately, the Square Root transformation was selected for its suitability. In addition, the TAR variable does not follow a normal distribution, so the researcher explored various transformation methods. Ultimately, the power with a lambda value of 2 transformations was selected for its suitability. Subsequently, the researcher re-conducted the Kolmogorov-Smirnov test on the transformed data for LMS and TAR to assess normality. The results showed p-values of 0.200 for LMS and 0.172 for TAR, both greater than 0.05, indicating that the transformed data for both LMS and TAR followed a normal distribution.

The resulting model, designed to examine the influence of TAR on LMS in the Palestinian banking sector from 2015 to 2022, is based on Equation No. (14) that was previously outlined in Chapter Three:

$$LMS = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (14)$$

The model was transformed using a Square Root function and the data was then fitted to several models including, linear, 2FI, quadratic, and Cubic models. The Table No. (4.8). compares different regression models based on their sequential p-values, adjusted R^2, and predicted R^2 to evaluate their performance. The linear model shows a significant fit with a p-value of < 0.0001 but has lower adjusted R^2 (0.8537) and predicted R^2 (0.8425) compared to more complex models. The 2FI model improves slightly with an adjusted R^2 of 0.8719 and a predicted R^2 of 0.8516 but is still outperformed by the quadratic model. The quadratic model, with a sequential p-value of < 0.0001, achieves a high adjusted R^2 of 0.9170 and a

predicted R^2 of 0.8910, indicating it provides a robust fit and strong predictive accuracy. Although the cubic model has the highest adjusted R^2 (0.9706) and predicted R^2 (0.9499), it is aliased by the statistical analysis software, suggesting potential issues with overfitting or multicollinearity. Therefore, the quadratic model is suggested as the most appropriate choice due to its balance of fit and predictive reliability, which is a form of polynomial regression that incorporates model terms up to the second degree and will test the interaction between model terms to effectively capture complex non-linear relationships within the data.

Table No. (4.8): Statistical Data Fitting Results for LMS and TAR Model

Source	Sequential p-value	Adjusted R^2	Predicted R^2	Note
Linear	< 0.0001	0.8537	0.8425	
2FI	0.0116	0.8719	0.8516	
Quadratic	< 0.0001	0.9170	0.8910	Suggested
Cubic	< 0.0001	0.9706	0.9499	Aliased

To determine the significance of the model and its terms, an ANOVA test was conducted. The results, summarized in Table No. (4.9), assess the LMS and TAR model, which examines the effects of various predictors and their interactions on the response variable. The overall model is highly significant (p-value < 0.0001), as indicated by an F-value of 69.63, suggesting a strong fit. Among the main predictors, TAR (p-value = 0.0036), Bank size (p-value < 0.0001), and the quadratic term for Bank size² (p-value < 0.0001) emerged as highly significant contributors. Conversely, Inflation rate (p-value = 0.6360) and GDP Growth (p-value = 0.3309) were not found to have significant effects on the response variable.

Regarding model interaction terms, TAR*Bank size is significant (p-value = 0.0025), suggesting an interaction effect between these two predictors. Other interaction terms, such as TAR*Inflation rate and Inflation rate*GDP Growth, are not significant. Additionally, the quadratic terms for TAR², Inflation rate², and GDP Growth² show no significant contributions. The residual mean square is relatively low (0.0012), reflecting limited unexplained variability. These findings highlight that Bank size and its interactions with TAR are critical factors in the model, whereas other predictors, especially those related to Inflation rate and GDP Growth, have minimal impact.

Table No. (4.9): ANOVA for Response Surface Quadratic- LMS and TAR Model

Source	Sum of Squares	df	Mean Square	β -value	F-value	p-value	Status
Model	1.20	14	0.0856	+0.120240	69.63	< 0.0001	Significant
TAR	0.0111	1	0.0111	-3.66612	9.03	0.0036	Significant
Inflation rate	0.0003	1	0.0003	+0.777325	0.2258	0.6360	-
Bank size	0.0492	1	0.0492	+1.36481E-10	39.98	< 0.0001	Significant
GDP Growth	0.0012	1	0.0012	+0.073290	0.9580	0.3309	-
TAR*Inflation rate	0.0001	1	0.0001	+14.79480	0.1200	0.7300	-
TAR*Bank size	0.0121	1	0.0121	+4.58338E-09	9.82	0.0025	Significant
TAR*GDP Growth	0.0005	1	0.0005	-6.52215	0.3966	0.5308	-
Inflation rate* Bank size	0.0013	1	0.0013	-2.25237E-10	1.04	0.3123	-
Inflation rate* GDP Growth	0.0035	1	0.0035	-32.52179	2.81	0.0980	-
Bank size* GDP Growth	0.0008	1	0.0008	+4.07494E-11	0.6280	0.4307	-
TAR^2	0.0005	1	0.0005	-46.33383	0.3667	0.5467	-
Inflation $rate^2$	0.0000	1	0.0000	-2.48872	0.0103	0.9196	-
Bank $size^2$	0.0553	1	0.0553	-1.21750E-20	44.97	< 0.0001	Significant
GDP $Growth^2$	0.0000	1	0.0000	+0.167731	0.0099	0.9210	-
Residual	0.0898	73	0.0012				
Cor Total	1.29	87					

Where: TAR (Technological Assets Ratio), LMS (Loan Market Share).

In this study, the null hypothesis for the ANOVA test posits that the parameters (independent variables) have no significant effect on the response (dependent variable). Statistical significance was determined using a criterion where a p-value less than or equal to 0.05 for the model and its terms indicate a significant effect ***(Field, 2018)***. So based on the findings, the researcher accepts the second hypothesis, $H_{1.2}$, which states that the ***Technological Assets Ratio (TAR) significantly enhances the bank's market share from loans from banks in Palestine.*** This conclusion is supported by the ANOVA results, where the significant p-value for the model (< 0.0001). and the model term (TAR) is identified as a significant predictor with a p-value of 0.0036, indicating its substantial influence on the response variable within the regression model. This relationship was particularly evident in the Bank of Palestine, whereas it was less pronounced in the Jordan Ahli Bank.

Table No. (4.10) illustrated that the model exhibits strong predictive power and precision. The mean of the response variable is 0.2762, with a standard deviation of 0.0351, indicating a relatively low spread around the mean. The R^2 value of 0.9303 suggests that approximately 93.03% of the variability in the response

variable is explained by the model, which is a strong fit. The adjusted R^2 of 0.9170 accounts for the number of predictors and still indicates a high level of explanatory power, while the predicted R^2 of 0.8910 suggests the model generalizes well to new data.

The coefficient of variation of 12.7% reflects the model's relative dispersion, indicating a reasonable balance between variability and mean. The PRESS statistic of 0.1405 indicates how well the model fits the data, with lower values reflecting a better model. Lastly, the adequate precision of 29.1538 is significantly greater than 4, suggesting that the model has good predictive reliability and precision, meeting the threshold for an adequate model ***(Schultz et al., 2017).*** the difference between R^2adjusted and R^2predicted is less than 0.2, indicating that the model is adequately precise for describing the working space ***(Neter et al., 1996)***, These results suggest that the model is robust and can be confidently used for predictions in similar contexts.

Table No. (4.10): Statistical Results for LMS and TAR Model

Statistical	Results	Statistical	Results
Mean	0.2762	R^2	0.9303
Standard deviation	0.0351	Adjusted R^2	0.9170
Coefficient of variation (%)	12.7	Predicted R^2	0.8910
PRESS	0.1405	Adequate Precision	29.1538

Since the model was significant, it can be utilized to predict the effects of the Technological Assets Ratio (TAR) on the Loan Market Share (LMS). The effects of TAR on LMS can be estimated using the equation No. (20) derived from the regression model illustrated in table No. (4.9).

$$\text{Sqrt(LMS)} = 0.120240 - 3.66612\ \text{TAR} + 0.777325\ \text{Inflation rate} + 1.36481 * 10^{-9}\ \text{Bank size} + 0.073290\ \text{GDP} + (14.79480\ \text{TAR} * \text{Inflation rate}) + (4.58338 * 10^{-9}\ \text{TAR} * \text{Bank size}) - (6.52215\ \text{TAR} * \text{GDP}) - (2.25237 * 10^{-10}\ \text{Inflation rate} * \text{Bank size}) - (32.52179\ \text{Inflation rate} * \text{GDP}) + (4.0749 * 10^{-11}\ \text{Bankd size} * \text{GDP}) - 46.33383\ \text{TAR}^2 - 2.48872\ \text{Inflation rate}^2 - 1.21750 * 10^{-20}\text{Bank size}^2 + 0.167731\ \text{GDP}^2 \quad (20)\ *$$

**Since this equation is derived from the Quadratic model, some variables are raised to the power of two, and it also includes terms that capture the interaction effects between pairs of independent variables.*

The residuals from the model were used to assess homoscedasticity using the Breusch-Pagan/Cook-Weisberg test and autocorrelation using the Durbin-Watson test. The results indicated that the effect of the Technological Assets Ratio (TAR) on the Loan Market Share Ratio (LMS) model satisfies the assumption of homoscedasticity at a significant level of 0.05, with no evidence of autocorrelation in the data, as shown in Table No. (4.11).

Table No. (4.11): Breusch-Pagan and Durbin-Watson Test Results for LMS and TAR Model

Breusch-Pagan		Durbin-Watson	
Multiple R	0.5152	Calculated D	1.13152
R Square: rbp^2	0.2655	DU	1.3056
Observation	88	DL	2.031
$X^2calc = n*rbp^2$	23.362	D<DL: Accept the null hypothesis and conclude no autocorrelation for the data	
K	14		
X Table	23.685		
P-value >0.05: Accept the null hypothesis and conclude Homoscedasticity of the model.			

4.4.3 Effect of Technological Assets Ratio on the Return on Equity

The third dependent variable examined was the Return on Equity (ROE), as the first key indicator of a bank's financial performance. The study evaluated the influence of the Technological Asset Ratio (TAR), which represents the level of FinTech adoption by banks, on ROE using Response Surface Methodology (RSM). Since the normality test, as discussed earlier, confirmed that the ROE variable follows a normal distribution, no transformation techniques were required. Although the TAR variable does not follow a normal distribution, the researcher evaluated several transformation methods and ultimately determined that the power with a lambda value of 2 transformations was the most appropriate. Subsequently, the researcher re-conducted the Kolmogorov-Smirnov test on the transformed TAR data to assess normality. The results showed a p-value of 0.172, greater than 0.05, indicating that the transformed TAR data followed a normal distribution.

The resulting model, designed to analyze the impact of TAR on ROE in the Palestinian banking sector between 2015 and 2022, is formulated based on Equation No. (15), as outlined in Chapter Three. This model serves as a valuable tool for understanding how FinTech adoption influences financial performance within this context.

$$ROE = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (15)$$

The data was then fitted to several models including, linear, 2FI, quadratic, and Cubic models. Table No. (4.12) compares the performance of different regression models, including linear, 2FI (Two-Factor Interaction), quadratic, and cubic models, based on their sequential p-values, adjusted R^2, and predicted R^2. The linear model shows a highly significant sequential p-value (< 0.0001), but its adjusted R^2 (0.3103) and predicted R^2 (0.2514) are relatively low, indicating that the model has limited explanatory power and predictive accuracy. The 2FI model has a sequential p-value of 0.1353, which is not statistically significant, and its adjusted R^2 (0.3429) and predicted R^2 (0.2242) are also low, suggesting poor model fit and predictive performance.

The quadratic model, on the other hand, provides a significant sequential p-value (< 0.0001) and performs better in terms of model fit. With an adjusted R^2 of 0.5109 and predicted R^2 of 0.3946, it indicates a good fit and reasonable predictive accuracy. This model is therefore suggested as the most appropriate option for the given analysis. Lastly, the cubic model has a significant sequential p-value (0.0001) and the highest adjusted R^2 (0.7010) and predicted R^2 (0.5019). However, it is labeled as "Aliased," by the statistical analysis software meaning it may suffer from overfitting or multicollinearity issues, which diminishes its reliability. In conclusion, the quadratic model is recommended due to its balanced performance, with significant results, a reasonable fit, and reliable predictive accuracy. While the cubic model provides the highest adjusted R^2, its aliasing issue makes it less reliable for predictive purposes. Based on that the researcher will employ a quadratic model, a type of polynomial regression that includes terms up to the second degree and will test the interaction between model terms to effectively capture non-linear relationships within the data.

Table No. (4.12): Statistical Data Fitting Results for ROE and TAR Model

Source	Sequential p-value	Adjusted R^2	Predicted R^2	Note
Linear	< 0.0001	0.3103	0.2514	
2FI	0.1353	0.3429	0.2242	
Quadratic	< 0.0001	0.5109	0.3946	Suggested
Cubic	0.0001	0.7010	0.5019	Aliased

The ANOVA results for the model analyzing the impact of the Technological Asset Ratio (TAR) on Return on Equity (ROE) highlight the significance of various factors and their interactions as shown in Table No. (4.13). The overall model is significant, with a p-value of < 0.0001 and an F-value of 17.83, indicating a strong fit and robust explanatory power.

Among the main effects, TAR (p = 0.0068), Bank size (p = 0.0005), and GDP Growth (p = 0.0066) significantly influence ROE, showcasing their critical role in shaping financial performance. Interestingly, the squared terms for TAR^2 (p < 0.0001), Inflation $rate^2$ (p = 0.0349), and Bank $size^2$ (p = 0.0005) are also significant, indicating non-linear relationships between these variables and ROE.

In terms of model interactions, TAR*GDP $Growth^2$ (p = 0.0174) is significant, suggesting a combined influence of TAR and GDP growth on ROE. However, the

interaction term TAR*GDP Growth (p = 0.8936) and the squared term GDP Growth² (p = 0.9987) are not significant, indicating these specific interactions do not substantially affect ROE. The residual mean square is relatively low (0.0503), reflecting limited unexplained variability.

In conclusion, the model demonstrates that TAR and its higher-order terms, along with Bank size, GDP Growth, and specific interaction terms, significantly impact ROE. This reinforces the importance of FinTech adoption (measured by TAR) and other economic indicators in influencing the financial performance of banks in Palestine.

Table No. (4.13): ANOVA for Response Surface Quadratic - ROE and TAR Model

Source	Sum of Squares	df	Mean Square	β -value	F-value	p-value	Status
Model	0.1434	10	0.0120	+0.107529	17.83	< 0.0001	Significant
TAR	0.0052	1	0.0052	-35.38218	7.76	0.0068	Significant
Inflation rate	0.0002	1	0.0002	-1.02155	0.2616	0.6105	-
Bank size	0.0088	1	0.0088	+4.15831E-11	13.12	0.0005	Significant
GDP Growth	0.0052	1	0.0052	+0.161472	7.81	0.0066	Significant
TAR*GDP Growth	0.0000	1	0.0000	+4.90377	0.0180	0.8936	-
TAR²	0.0122	1	0.0122	+4244.47250	18.21	< 0.0001	Significant
Inflation rate²	0.0031	1	0.0031	+38.51423	4.62	0.0349	Significant
Bank size²	0.0088	1	0.0088	-4.88667E-21	13.12	0.0005	Significant
GDP Growth²	1.805E-09	1	1.805E-09	-3.79580	2.693E-06	0.9987	-
TAR*GDP Growth²	0.0040	1	0.0040	+240.38210	5.91	0.0174	Significant
Residual	0.0503	75	0.0007				
Cor Total	0.1937	87					

Where: TAR (Technological Assets Ratio), ROE (Return on Equity).

In this study, the null hypothesis for the ANOVA test posits that the parameters (independent variables) have no significant effect on the response (dependent variable). Statistical significance was determined using a criterion where a p-value less than or equal to 0.05 for the model and its terms indicate a significant effect ***(Field, 2018)***. So based on these findings, the researcher accepts the third hypothesis, $H_{2.1}$, which states that the ***Technological Assets Ratio (TAR) significantly improves the Return on Equity (ROE) of banks in Palestine***. This conclusion is strongly supported by the ANOVA results, which identify the significant p-value for the model (< 0.0001), and the model term (TAR) as a significant factor with a p-value of 0.0068, highlighting its positive and substantial

impact on ROE within the regression model. This relationship was particularly evident in the Arab Bank, whereas it was less pronounced in the Housing Bank for Trade & Finance.

Table No. (4.14) illustrated that the model exhibits strong predictive power and precision. The mean is 0.0839, with a standard deviation of 0.0259. The R^2 value of 0.7404 suggests that the model explains 74.04% of the variance in the dependent variable, indicating a strong overall fit. The adjusted R^2 of 0.5109 adjusts for the number of predictors used, reflecting that about 51.09% of the variance is explained, considering the model's complexity. The predicted R^2 of 0.3946 indicates the model's ability to predict new data, while the coefficient of variation is 30.87%, indicating a moderate level of variability relative to the mean.

Additionally, the PRESS value of 0.0736 reflects the prediction error sum of squares, and the adequate precision of 19.2272 suggests the model is reliable for prediction, as values above 4 are considered sufficient ***(Schultz et al., 2017)***. the difference between R^2adjusted and R^2predicted is less than 0.2, indicating that the model is adequately precise for describing the working space ***(Neter et al., 1996)***. Overall, these metrics demonstrate a reasonably strong model fit, with good predictive power, though the adjusted R^2 indicates potential for further refinement.

Table No. (4.14): Statistical Results for ROE and TAR Model

Statistical	Results	Statistical	Results
Mean	0.0839	R^2	0.7404
Standard deviation	0.0259	Adjusted R^2	0.5109
Coefficient of variation (%)	30.87	Predicted R^2	0.3946
PRESS	0.0736	Adequate Precision	19.2272

Since the model is statistically significant, it can be used to predict the impact of the Technological Assets Ratio (TAR) on the Return on Equity (ROE). The relationship between TAR and ROE can be estimated using equation No. (21) derived from the regression model illustrated in table No. (4.13):

$$\text{ROE} = 0.107529 - 35.38218\ \text{TAR} - 1.02155\ \text{Inflation rate} + 4.15831 * 10^{-11}\ \text{Bank size} + 0.161472\ \text{GDP} + (4.90377\ \text{TAR} * \text{GDP}) + 4{,}244.47250\ \text{TAR}^2 + 38.51423\ \text{Inflation rate}^2 - 4.88667 * 10^{-21}\ \text{Bank size}^2 - 3.79580\ \text{GDP}^2 + (240.38210\ \text{TAR} * \text{GDP}^2) \quad (21)\ *$$

**Since this equation is derived from the Quadratic model, some variables are raised to the power of two, and it also includes terms that capture the interaction effects between pairs of independent variables.*

The residuals from the model were used to assess homoscedasticity using the Breusch-Pagan/Cook-Weisberg test and autocorrelation using the Durbin-Watson test. The results indicated that the effect of the Technological Assets Ratio (TAR) on the Return on Equity Ratio (ROE) model satisfies the assumption of homoscedasticity at a significant level of 0.05, with no evidence of autocorrelation in the data, as shown in Table No. (4.15).

Table No. (4.15): Breusch-Pagan and Durbin-Watson Test Results for ROE and TAR Model

Breusch-Pagan		Durbin-Watson	
Multiple R	0.365	Calculated D	1.334
R Square: rbp^2	0.1332	DU	1.9704
Observation	88	DL	1.3582
$X^2calc = n*rbp^2$	11.721	D<DL: Accept the null hypothesis and conclude no autocorrelation for the data	
K	12		
X Table	21.026		
P-value >0.05: Accept the null hypothesis and conclude Homoscedasticity of the model.			

4.4.4 Effect of Technological Assets Ratio on the Net Interest Margin

The potential interactions between the Technological Asset Ratio (TAR), representing a bank's FinTech adoption level, and the Net Interest Margin (NIM), as a second key measure of the bank's financial performance, were modeled using Response Surface Methodology (RSM). Since the Net Interest Margin (NIM) variable follows a normal distribution, as confirmed by the normality test discussed earlier, no transformation methods are necessary. Although the TAR variable does not follow a normal distribution, the researcher evaluated several transformation methods and ultimately determined that the power with a lambda value of 2 transformations was the most appropriate. Subsequently, the researcher re-conducted the Kolmogorov-Smirnov test on the transformed TAR data to assess normality. The results showed a p-value of 0.172, greater than 0.05, indicating that the transformed TAR data followed a normal distribution.

The resulting model, designed to evaluate the impact of the Technological Assets Ratio (TAR) on the Net Interest Margin (NIM) within the Palestinian banking sector from 2015 to 2022, is based on Equation No. (16), as outlined in Chapter Three.

$$NIM = \beta_o + \sum_{i=2015}^{2022} \beta_i TAR_i \sum_{i=2015}^{2022} \beta_{ii} TAR_i^2 + \sum_{i=2015}^{2022} \sum_{j=2015}^{2022} \beta_{ij} TAR_i CV_j + \varepsilon \quad (16)$$

The data was then fitted to several models including, linear, 2FI, quadratic, and Cubic models. Table No. (4.16) illustrates the results from the model comparison show that all models exhibit weak fit and predictive power. The Linear model, with a p-value of 0.1891, has an adjusted R^2 of 0.0257 and a predicted R^2 of 0.0209, suggesting a poor model fit. The 2FI (Two-Factor Interaction) model, with a p-value of 0.1543, shows an adjusted R^2 of 0.0672 and a predicted R^2 of 0.0022, indicating even weaker performance. The Quadratic model has a p-value of 0.4049, with an adjusted R^2 of 0.0679 and a predicted R^2 of 0.0461, also reflecting poor fit and predictive power. The Cubic model, with a p-value of 0.6134, an adjusted R^2 of 0.0373, and a predicted R^2 of 0.6151, shows a high predicted R^2 but is considered aliased by the statistical analysis software, suggesting overfitting or inappropriateness for prediction. Overall, none of the

models perform well, with the Cubic model having the highest predicted R^2 but being flagged for potential overfitting.

Table No. (4.16): Statistical Data Fitting Results for NIM and TAR Model

Source	Sequential p-value	Adjusted R^2	Predicted R^2	Note
Linear	0.1891	0.0257	0.0209	
2FI	0.1543	0.0672	0.0022	
Quadratic	0.4049	0.0679	0.0461	
Cubic	0.6134	0.0373	0.6151	Aliased

Table No. (4.17) presented ANOVA results which indicate that the overall model is not significant (p-value = 0.1149), suggesting that the factors included in the model do not significantly explain the variation in the dependent variable. Among the individual predictors, none were found to be statistically significant at the 5% significance level. Specifically, Technological Asset Ratio (TAR) (p-value = 0.0691), Inflation rate (p-value = 0.0732), Bank size (p-value = 0.0953), and GDP Growth (p-value = 0.1129) all had p-values above the threshold of 0.05, indicating that these factors do not have a significant effect on the dependent variable. Furthermore, the interaction terms, such as TAR*Inflation rate, TAR*Bank size, and TAR*GDP Growth, as well as other two-way interactions like Inflation rate*Bank size and Bank size*GDP Growth, were also not significant. The residual sum of squares is 0.0217, indicating that the unexplained variation in the model is higher than the explained variation. Therefore, the model does not provide a good fit for predicting the response variable.

Table No. (4.17): ANOVA for Response Surface 2FI - NIM and TAR Model

Source	Sum of Squares	df	Mean Square	F-value	p-value	Status
Model	0.0046	10	0.0005	1.63	0.1149	Not Significant
TAR	0.0010	1	0.0010	3.40	0.0691	Not Significant
Inflation rate	0.0009	1	0.0009	3.30	0.0732	Not Significant
Bank size	0.0008	1	0.0008	2.85	0.0953	Not Significant
GDP Growth	0.0007	1	0.0007	2.57	0.1129	Not Significant
TAR*Inflation rate	0.0002	1	0.0002	0.6267	0.4310	Not Significant
TAR*Bank size	0.0013	1	0.0013	4.77	0.0320	Not Significant
TAR*GDP Growth	0.0003	1	0.0003	0.9871	0.3236	Not Significant
Inflation rate*Bank size	0.0004	1	0.0004	1.47	0.2289	Not Significant

Inflation rate*GDP Growth	0.0005	1	0.0005	1.89	0.1729	Not Significant
Bank size*GDP Growth	0.0007	1	0.0007	2.47	0.1198	Not Significant
Residual	0.0217	77	0.0003			
Cor Total	0.0263	87				

Where: TAR (Technological Assets Ratio), NIM (Net Interest Margin).

In this study, the null hypothesis for the ANOVA test posits that the parameters (independent variables) have no significant effect on the response (dependent variable). Statistical significance was determined using a criterion where a p-value less than or equal to 0.05 for the model and its terms indicate a significant effect ***(Field, 2018)***. So based on these findings, the researcher rejects the fourth hypothesis, $H_{2.2}$, which posited ***that the Technological Assets Ratio (TAR) significantly improves the Net Interest Margin (NIM) of banks in Palestine***. The ANOVA results show that the model with a p-value (0.1149) and model term (TAR) with a p-value (0.0691), along with other predictors and their interactions, do not significantly influence the NIM, as indicated by p-values greater than the 0.05 threshold. With a non-significant model (p-value = 0.1149), it can be concluded that TAR does not have a substantial impact on NIM in the Palestinian banking sector.

Since the model is not statistically significant, it cannot be used to predict the impact of the Technological Assets Ratio (TAR) on the Net Interest Margin (NIM). The lack of significant predictors and the overall non-significance of the model (p-value = 0.1149) indicate that the relationship between TAR and NIM in the Palestinian banking sector is not well-explained by the current model. And no need for Homoscedasticity and Autocorrelation tests.

4.5 Presentation of Finding

As previously discussed regarding the procedures followed by the researcher to conduct the data analysis, Table No. (4.18) below summarizes the best-fitting model used to test each hypothesis, along with the corresponding results, including the sequential p-value, adjusted R^2, and predicted R^2.

Table No. (4.18) shows that $H_{1.1}$ is best fitted by a cubic model. The sequential p-value of 0.0494 indicates a statistically significant relationship, while the adjusted R^2 of 0.4764 suggests that the model explains 47.64% of the variance in the data. The predicted R^2 of 0.4132 further supports the model's predictive capability. For $H_{1.2}$, the quadratic model is the best fit, with an exceptionally low sequential p-value (<0.0001), confirming a strong relationship. The adjusted R^2 of 0.9170 indicates that the model explains 91.70% of the variance, and the predicted R^2 of 0.8910 demonstrates robust predictive accuracy.

For $H_{2.1}$, the quadratic model provides the best fit, with a sequential p-value of <0.0001, indicating a highly significant relationship. The adjusted R^2 of 0.5109 shows that the model accounts for over half of the variance, while the predicted R^2 of 0.3946 suggests moderate predictive capability. Finally, $H_{2.2}$ is best fitted by a two-factor interaction (2FI) model. The sequential p-value of 0.1543 indicates that the relationship is not statistically significant at the conventional level, and both the adjusted R^2 (0.0672) and predicted R^2 (0.0022) are very low, suggesting that the model does not provide a good fit for this hypothesis.

Table No. (4.18) Summary of the Best-Fitting Model Used to Test Each Hypothesis.

Hypotheses	Best-Fitting Model	Sequential p-value	Adjusted R^2	Predicted R^2
$H_{1.1}$: Technological assets ratio significantly enhances the Cost-to-Income ratio of banks in Palestine.	Cubic	0.0494	0.4764	0.4132
$H_{1.2}$: Technological assets ratio significantly enhances the bank's market share from loans of banks in Palestine.	Quadratic	< 0.0001	0.9170	0.8910
$H_{2.1}$: Technological assets ratio significantly improves the Return on Equity (ROE) of banks in Palestine.	Quadratic	< 0.0001	0.5109	0.3946

$H_{2.2}$: Technological assets ratio significantly improves the Net Interest Margin (NIM) of banks in Palestine.	2FI	0.1543	0.0672	0.0022

Table No. (4.19) below presents the results of the hypothesis testing, including the p-values for the model and the Technological Assets Ratio (TAR) using the ANOVA test and the status of each hypothesis based on statistical significance. The results of the hypothesis testing reveal that the technological assets ratio significantly enhances the Cost-to-Income ratio (CIR), Loan market share (LMS), and Return on Equity (ROE) of banks in Palestine. For each of these relationships, the p-values for both the model and the Technological Assets Ratio (TAR) were below the conventional significance level of 0.05, indicating statistical significance and leading to the acceptance of these hypotheses. In contrast, the hypothesis that the technological assets ratio improves the Net Interest Margin (NIM) of banks was not supported, as both the model and TAR p-values were above the 0.05 threshold, indicating a lack of statistical significance. Therefore, this hypothesis is rejected. Overall, the findings suggest that the technological assets ratio plays a significant role in influencing the CIR, LMS, and ROE, but does not have a significant impact on NIM.

In summary, hypotheses $H_{1.1}$, $H_{1.2}$, and $H_{2.1}$ are accepted due to their statistical significance, while $H_{2.2}$ is rejected based on the lack of significance in both the model and TAR p-values.

Table No. (4.19): Results of Testing the Hypotheses

Hypotheses	Model - p-value	TAR - p-value	Status
$H_{1.1}$: Technological assets ratio significantly enhances the Cost-to-Income ratio of banks in Palestine.	< 0.0001	< 0.0001	Accept
$H_{1.2}$: Technological assets ratio significantly enhances the bank's market share from loans of banks in Palestine.	< 0.0001	0.0036	Accept

$H_{2.1}$: Technological assets ratio significantly improves the Return on Equity (ROE) of banks in Palestine.	< 0.0001	0.0068	Accept
$H_{2.2}$: Technological assets ratio significantly improves the Net Interest Margin (NIM) of banks in Palestine.	0.1149	0.0691	Reject

Chapter 5: Discussion and Recommendations

5.1 Introduction

This chapter begins by revisiting the primary objectives of the study, which aim to shed light on the evolving role of FinTech in the modern economic and financial landscape. The study provides a comprehensive overview of FinTech, emphasizing its significance and transformative impact on banking operations and competitiveness. A key focus of the research is analyzing the relationship between the level of FinTech adoption, as measured by the Bank Technological Assets Ratio, and the competitiveness of banks. Competitiveness is assessed through two critical metrics: the Bank Cost-to-Income Ratio and the Bank Loan Market Share. Additionally, the study examines the impact of FinTech adoption on banks' financial performance, with a specific focus on two indicators: the Bank Return on Equity (ROE) and the Bank Net Interest Margin (NIM) ratios. By addressing these objectives, this research seeks to provide valuable insights into the role of FinTech in shaping the banking sector, particularly within the unique context of the Palestinian financial system.

To achieve this, the study employs the Response Surface Methodology (RSM) for data analysis, offering a distinct advantage by providing deeper insights into complex relationships. This methodology facilitates optimal resource allocation, enhances predictive accuracy, and proves to be highly effective in analyzing and interpreting key financial and competitive dynamics.

This chapter will interpret the findings in alignment with the study's objectives, analyzing their significance and underlying mechanisms, and comparing them with existing literature to identify consistencies, contrasts, and contributions to the field. The discussion will explore how the results address the research objectives, particularly in the context of developing economies, and will provide actionable recommendations for banks, policymakers, and other stakeholders to enhance competitiveness and financial performance using FinTech. Finally, it will identify the limitations of the study and suggest avenues for future research to expand on these insights, ensuring continued exploration of the evolving role of FinTech in the banking sector.

5.2 Findings Interpretation and Comparison with Existing Literature

5.2.1 Effect of FinTech Adoption on Bank Competitiveness

One of the main objectives of this research is to examine the relationship between the level of FinTech adoption, quantified using the Bank Technological Assets Ratio (TAR), and banks' competitiveness. Competitiveness is evaluated using two key indicators: the Cost-to-Income Ratio (CIR), which reflects operational efficiency, and the Loan Market Share (LMS), representing a bank's position in the lending market.

For the first measure of competitiveness, the Bank Cost-to-Income Ratio (CIR), the researcher examined the relationship between FinTech adoption level, measured by the Bank Technological Assets Ratio (TAR), The results reveal a negative relationship between CIR and TAR, indicating that increased FinTech adoption reduces the CIR. This suggests that banks leveraging FinTech can execute operations more efficiently, leading to lower operational costs. Consequently, these banks are better positioned to offer services and products at more competitive prices, enhancing their market competitiveness relative to other banks. This result is confirmed by the study conducted by ***Alhassan and Asare (2016)*** within the MENA region, which demonstrates that banks with lower Cost-to-Income Ratios (CIRs) due to the use of FinTech are more adaptable and responsive to market changes. This is particularly significant in developing economies, where cost efficiency plays a crucial role in maintaining competitiveness. Their findings suggest that a low CIR due to the use of FinTech enables banks to offer more competitive products, invest in innovative solutions, and sustain customer loyalty, ultimately enhancing their market position.

Moreover, the results align with a study by ***Dwivedi et al. (2021)***, which found a significant positive impact of FinTech adoption on competitiveness in the UAE banking sector. Similarly, a study by ***Wang et al. (2021)*** emphasizes that organizations leveraging FinTech are better able to tailor their offerings to meet customer needs, enhancing customer satisfaction and loyalty. This focus on personalized services allows banks to differentiate themselves from competitors and build stronger customer relationships, which are essential for long-term

success. Both studies support the idea that FinTech adoption enables banks to improve operational efficiency, better respond to market demands, and strengthen their competitive position.

FinTech adoption can enhance the Cost-to-Income Ratio (CIR) by improving operational efficiency and reducing costs. By leveraging advanced technologies such as automation, artificial intelligence, and digital platforms, banks can streamline their processes, minimize manual tasks, and reduce reliance on physical infrastructure. These improvements lead to lower operational expenses, which in turn reduce the cost side of the CIR. Additionally, FinTech solutions facilitate better data management, more accurate risk assessments, and enhanced customer service, further optimizing bank operations. This is consistent with the findings of several studies, such as those conducted by ***Momaya (2019), Panchal and Krishnamoorthy (2019), and Wang et al. (2021)***, which highlight the positive impact of FinTech on operational efficiency and cost reduction in the banking sector.

For the second measure of competitiveness, the Bank Loan Market Share (LMS), the researcher examined the relationship between FinTech adoption level, measured by the Bank Technological Assets Ratio (TAR), The analysis indicates a positive relationship between the two factors. This can be explained by the fact that FinTech enables banks to enhance their loan offerings by improving customer experience through data analytics, reducing non-performing loans, and refining risk assessments. These improvements allow banks to expand their loan portfolios, which in turn boosts their market share and competitiveness. Additionally, banks with larger loan market shares tend to exhibit better liquidity management and are less vulnerable to certain financial risks, further strengthening their position in the industry. This aligns with studies conducted by ***Davis et al. (2020) and Dai & Vasarhelyi (2019)***, which also highlight the positive impact of FinTech adoption on a bank's loan market share. Both studies emphasize how the integration of advanced technologies, such as data analytics and enhanced risk management tools, can improve a bank's lending processes, reduce risks, and ultimately help expand their loan portfolios, leading to increased competitiveness and market share.

Based on the analysis and results, it can be concluded that the adoption of financial technology (FinTech) has a positive impact on the competitiveness of banks. This effect is evident in two key dimensions. First, FinTech adoption helps reduce traditional operating expenses and transaction costs, directly enhancing the bank's competitiveness by improving efficiency and lowering overheads. Second, these cost savings enable banks to offer their products at more competitive prices, which can lead to an increase in market share. Additionally, FinTech empowers banks to reach new customer segments that were previously difficult to access through traditional methods, further expanding their market presence and driving growth. This conclusion is consistent with the findings of several studies, including those conducted by ***Philippon (2016), Zhao et al. (2019), and Soon et al. (2023)***.

In conclusion, the researcher successfully addresses the study's first objective by analyzing the relationship between FinTech adoption and the competitiveness of banks. This is achieved through: examining the relationship between FinTech adoption level, represented by the Bank Technological Assets Ratio (TAR), and competitiveness, measured by both the Cost-to-Income Ratio (CIR) and the Loan Market Share Ratio (LMS).

Furthermore, the study answers the first research question in its two components. The findings reveal that the FinTech adoption level quantified using the TAR positively impacts bank competitiveness by enhancing both the CIR and the LMS, providing valuable insights into the role of FinTech in improving operational efficiency and market performance.

5.2.2 Effect of FinTech Adoption on Bank Financial Performance

The second main objective of the research is to investigate the relationship between the level of FinTech adoption, measured through the Bank Technological Assets Ratio (TAR), and the financial performance of banks. Financial performance is assessed using two key indicators: the Return on Equity (ROE), which captures the profitability generated relative to shareholders' equity, and the Net Interest Margin (NIM), which represents the efficiency of a bank in managing its interest income and expenses.

For the first dimension of financial performance, the Return on Equity (ROE), this study explores the relationship between FinTech adoption measured by the Bank Technological Assets Ratio (TAR). The findings reveal a positive correlation between ROE and TAR, indicating that higher FinTech adoption enhances ROE. This suggests that banks leveraging FinTech can improve profitability and operational efficiency, as streamlining processes and reducing operational costs contribute to better financial outcomes.

This finding aligns with the study by ***Shuli et al. (2022)*** conducted in China, which demonstrates a bidirectional relationship between FinTech development and ROE, as evidenced by the Granger causality test. Their study also highlights that a bank's asset size positively influences profitability, leading to improved net interest margins and reduced non-performing loans. Similarly, the results are consistent with the findings of ***Mashhadani et al. (2023)*** in the UAE, which reveal a significant positive relationship between FinTech adoption and bank performance. Their study shows that FinTech adoption enhances both ROA and ROE, improves operational efficiency, and helps banks attract more customers, thereby further boosting profitability.

In contrast, the findings of this study diverge from those reported by ***Abu Fara and Abu Karsh (2020)*** in their research on Kenya and Lithuania, particularly regarding the impact of FinTech on ROE. Their study reveals mixed results, with some statistical evidence suggesting that FinTech's presence might influence bank profitability; however, the overall effect is statistically insignificant in both markets. This suggests that traditional banks in these regions, while influenced by FinTech’s emergence, have not experienced significant disruptions in

profitability. This resilience can be attributed to their established customer bases and regulatory advantages, which provide a continued competitive edge.

Similarly, the findings differ from those of ***Brandl and Hornuf (2017)*** in Indonesia, who identified consistent negative effects of FinTech on bank performance, particularly ROE, across various contexts. The only exception was a slight positive impact noted for younger banks. Their study concludes that FinTech poses significant challenges to traditional banks, emphasizing the urgent need for these institutions to adapt and innovate in order to maintain their competitive position within the rapidly evolving financial landscape.

FinTech adoption can enhance Return on Equity (ROE) by improving operational efficiency and reducing costs. By leveraging advanced technologies such as automation, artificial intelligence, and data analytics, banks can streamline processes, minimize manual errors, and optimize resource allocation. These efficiencies lower operational expenses, allowing banks to achieve higher profitability relative to their equity base. Moreover, FinTech enables banks to innovate their product and service offerings, enhancing customer satisfaction and attracting a larger customer base. This expansion in revenue streams, coupled with cost reductions, directly contributes to an improved ROE. Additionally, FinTech solutions facilitate better risk management and decision-making, further strengthening the financial performance of banks. This is consistent with the findings of several studies, such as those conducted by ***(Gomber et al., 2018), Philippon (2016), Alnsour (2023)***, ***Baker et al. (2023), and Kaddumi et al. (2023)*** which highlight the positive impact of FinTech on financial performance in the banking sector.

The second dimension of financial performance, the Net Interest Margin (NIM), this study examines the relationship between FinTech adoption—measured by the Bank Technological Assets Ratio (TAR). The findings reveal no significant correlation between NIM and TAR, suggesting that the level of FinTech adoption does not directly influence NIM.

This outcome indicates that the adoption of financial technology has not yet impacted banks' pricing of products. One explanation for this is the relative

novelty of FinTech in Palestine, where it is still considered a modern and emerging concept in the market. As a result, banks may not yet have fully integrated FinTech innovations into their pricing strategies or financial structures. Additionally, the findings can be attributed to banks' adherence to the Monetary Authority's regulations on interest rates, which limit their ability to adjust pricing independently. These factors collectively suggest that while FinTech adoption may offer operational benefits, its influence on NIM in the Palestinian banking sector remains limited at this stage.

Previous studies present contrasting results to the findings of this study. For instance, ***soon et al. (2023)*** demonstrate that FinTech adoption has a significantly positive effect on bank performance in less developed countries. Their study highlights improvements in both return on assets (ROA) and net interest margins (NIM), particularly in nations with lower GDP per capita. The positive impact is especially pronounced in the least developed countries, where FinTech notably enhances ROA, and in countries at the 75th GDP percentile, where NIM sees significant improvement.

Conversely, ***Brandl and Hornuf (2017)*** report a negative relationship between FinTech adoption and key bank performance metrics. Their study finds that the introduction of each new FinTech firm is associated with reductions in NIM, ROE, ROA, and yield on earning assets (YEA). This suggests that the growing presence of FinTech firms may create competitive pressures that negatively affect traditional banks' performance.

These contrasting findings highlight that the impact of FinTech adoption on financial performance can differ greatly, influenced by factors such as economic context, market maturity, and the regulatory frameworks of individual countries.

However, when Net Interest Margin (NIM) is used as an indicator of financial performance, no significant relationship is observed between FinTech adoption and bank performance in the Palestinian context. This suggests that while FinTech enhances certain aspects of financial performance, such as profitability and efficiency (reflected in ROE), its influence on metrics tied to product pricing and interest income management (such as NIM) may be limited, possibly due to

regulatory constraints or the nascent stage of FinTech adoption in the Palestinian market.

In conclusion, the researcher effectively addresses the study's second objective by examining the relationship between FinTech adoption and the financial performance of banks. This analysis is conducted through two key dimensions: first, by exploring the link between FinTech adoption, represented by the Bank Technological Assets Ratio (TAR), and financial performance, assessed via the Return on Equity (ROE); and second, by investigating the relationship between FinTech adoption, also represented by the TAR, and financial performance, measured through the Net Interest Margin (NIM).

Furthermore, the study answers the second research question in its two components, offering valuable insights. The findings indicate that FinTech adoption, as measured by the TAR, positively impacts bank financial performance by enhancing ROE, demonstrating its influence on profitability and shareholder value. However, the results show no significant relationship between FinTech adoption, as quantified through the TAR, and financial performance as measured by NIM, suggesting a more nuanced impact of FinTech on bank performance metrics.

5.3 Limitations, Contribution, and Recommendations of the Study

This study identifies several limitations that highlight areas for future research. First, it lacks comparative analyses between Palestine and other developing economies, which could provide insights into how regulatory, cultural, and economic contexts shape FinTech adoption. Such research could enable broader generalizations and inform region-specific strategies for FinTech implementation.

Additionally, the study does not adopt a longitudinal approach, which would be beneficial in capturing the long-term impacts of FinTech adoption on competitiveness and financial performance. Tracking its integration over time could offer valuable perspectives on its sustained effects on banking operations and pricing strategies.

Another limitation is the lack of focus on sector-wide challenges to FinTech adoption, such as regulatory constraints, infrastructure gaps, and market readiness. Addressing these barriers in future research would help policymakers and financial institutions create an environment more conducive to FinTech innovation.

Lastly, the study also does not explore customer behavior and perceptions, which are critical for understanding the successful adoption of FinTech solutions. Investigating factors like trust in digital platforms, adoption rates, and satisfaction would aid in designing more customer-centric technologies that align with user needs and improve adoption rates.

The practical contribution of this study is evident in its findings, which reveal a positive relationship between the level of FinTech adoption and banks' competitiveness and financial performance. This relationship highlights the significant benefits of integrating FinTech into banking operations. The study provides valuable insights for banks aiming to optimize their FinTech investments, demonstrating how strategic adoption can enhance both operational efficiency and market positioning.

By adopting FinTech solutions, banks can improve their Cost-to-Income Ratio (CIR) and Loan Market Share (LMS), which are key indicators of competitiveness. Additionally, this optimization can lead to a higher Return on

Equity (ROE), further strengthening the banks' financial performance. These improvements collectively enhance the banks' financial indicators, solidifying their role in an increasingly digital financial environment.

Study findings highlight the importance of adopting targeted technological solutions to address gaps in competitiveness, enabling them to better compete with larger financial institutions, on the other hand, should adapt their FinTech strategies to align with the unique conditions of the local market. By doing so, they can ensure their offerings remain relevant to customers, fostering satisfaction and loyalty.

The study also has implications for policymakers and regulators. Regulatory authorities can leverage these findings to design policies that encourage FinTech adoption while safeguarding financial stability and system integrity. Policymakers should aim to create a balanced regulatory framework that promotes innovation while mitigating risks associated with digital financial solutions.

The study makes a significant theoretical contribution, as evidenced by its findings confirming a negative impact of FinTech adoption on the Cost-to-Income Ratio (CIR), and a positive impact on Loan Market Share (LMS) and Return on Equity (ROE). However, the lack of a significant relationship between FinTech adoption and Net Interest Margin (NIM) suggests that the influence of FinTech may vary depending on the performance metric. This finding highlights the context-specific nature of FinTech's benefits and calls for further theoretical exploration into the conditions under which FinTech adoption impacts financial performance. Understanding these nuances could refine existing theoretical models and provide deeper insights into the strategic role of FinTech in enhancing banks' competitiveness and overall performance.

Based on the results, which provide valuable insights for both banks and policymakers and regulators, the recommendations are structured as follows:

- **Recommendations of the Study Sample (Individual bank level)**
    - **Banks Should Invest in FinTech Solutions to Improve Operational Efficiency**

Banks should strategically prioritize investments in cutting-edge FinTech solutions, such as artificial intelligence (AI), big data analytics, and robotic process automation (RPA). These technologies offer transformative potential by automating routine tasks, reducing manual intervention, and streamlining processes. For example, AI can be deployed to optimize credit risk assessments, enhance fraud detection, and provide personalized customer experiences. Similarly, big data analytics enables banks to gain deeper insights into customer behaviors and market trends, allowing for more informed decision-making and tailored product offerings.

By adopting RPA, banks can automate back-office operations, such as compliance checks, data entry, and payment processing, significantly minimizing errors and reducing processing times. Collectively, these innovations can enhance operational efficiency, leading to measurable improvements in the Cost-to-Income Ratio (CIR). A lower CIR reflects a bank's ability to effectively manage expenses while maintaining revenue growth, an essential indicator of financial health and competitive positioning.

Furthermore, the adoption of advanced FinTech solutions directly contributes to improved profitability indicators, such as the Return on Equity Ratio (ROE). Streamlined operations reduce overhead costs, enabling banks to allocate resources more effectively to revenue-generating activities. This enhanced profitability allows banks to reinvest in further innovation, creating a positive cycle of technological advancement and financial performance.

In addition, investing in FinTech solutions equips banks to respond more effectively to dynamic market conditions and evolving customer expectations. With faster, more efficient operations, banks can focus on innovation, customer satisfaction, and market adaptability, ensuring long-term sustainability and growth. To maximize these benefits, banks should also foster a culture of digital transformation, invest in employee training to work alongside technology and collaborate with FinTech firms to co-develop tailored solutions.

- **Banks Should Enhance Loan Portfolio Management and Size**

Banks should leverage FinTech tools to enhance their credit assessment processes, ultimately improving the quality and size of their loan portfolios. Advanced technologies such as artificial intelligence (AI), machine learning (ML), and big data analytics can significantly improve the accuracy of credit risk evaluations. By analyzing large volumes of customer data—such as transaction history, income patterns, and even social behaviors—these tools can provide a more comprehensive and accurate assessment of a borrower's creditworthiness. This enables banks to make more informed lending decisions and reduce the risk of non-performing loans (NPLs), which can have a detrimental impact on their profitability and financial stability.

Incorporating FinTech solutions allows for more precise segmentation of borrowers, enabling banks to allocate credit more effectively. By distinguishing between high- and low-risk borrowers, banks can tailor their lending strategies, ensuring that they offer competitive terms to creditworthy individuals and institutions while mitigating potential losses from riskier loans. This approach not only reduces NPLs but also supports the overall health of the loan portfolio.

Moreover, the integration of these technologies enables banks to increase their Loan Market Share Ratio (LMS). By enhancing their credit assessment capabilities and offering more competitive, data-driven products, banks can attract a broader range of customers. As a result, they can expand their loan portfolios and increase their market presence. This growth in loan size also positions banks to capture a larger share of the lending market, improving their competitive advantage and boosting revenue streams from interest income.

Adopting FinTech tools also enhances operational efficiency in loan management. Automated processes for monitoring loans, detecting early signs of repayment issues, and managing loan collections can help banks reduce administrative costs and improve their responsiveness to potential problems. This not only ensures the long-term sustainability of the loan portfolio but also strengthens customer relationships through more timely and effective communication.

Overall, the adoption of FinTech tools in loan portfolio management enables banks to grow their loan portfolios, improve their financial performance, and gain a stronger position in the market. By reducing NPLs, effectively allocating credit, and increasing market share, banks can create a more robust and competitive lending business.

- **Banks Should Leverage FinTech in Product and Services Pricing**

  Banks should actively leverage FinTech solutions to optimize the pricing of their products and services. By utilizing advanced technologies such as big data analytics, artificial intelligence (AI), and machine learning (ML), banks can gain deeper insights into customer behavior, preferences, and financial needs. These technologies can analyze vast amounts of data to identify patterns and trends, allowing banks to better understand customer risk profiles and how they respond to different pricing structures. This enables them to offer personalized, dynamic pricing models that cater to individual customers while remaining competitive in the broader market.

  FinTech tools also allow banks to adjust pricing strategies in real-time, in response to changing market conditions and customer demand. For example, AI-powered models can predict how interest rates, economic shifts, or competitor pricing changes will influence consumer choices. By aligning product and service pricing with these insights, banks can attract more customers, retain existing ones, and increase their market share. Furthermore, tailored pricing can improve customer satisfaction by providing more affordable options for different segments, leading to enhanced customer loyalty and engagement.

  In addition to offering personalized pricing, FinTech can streamline the pricing process itself, improving accuracy and efficiency. By automating complex pricing models and integrating real-time data analysis, banks can eliminate manual errors, reduce decision-making time, and ensure consistent, competitive pricing across their products and services. This not only leads to more accurate pricing but also reduces operational costs associated with traditional pricing methods.

Ultimately, leveraging FinTech for pricing optimization can improve the profitability of a bank's products and services, directly impacting key performance indicators such as the Net Interest Margin (NIM). By reducing pricing inefficiencies and increasing customer acquisition and retention, banks can achieve better profitability while remaining competitive in the dynamic financial market. This strategic use of technology in pricing also positions banks to better meet the evolving needs of their customers, fostering long-term growth and success.

- **Banks Should Promote Financial Inclusion Through FinTech**

FinTech has the potential to play a transformative role in expanding financial inclusion by providing digital banking services to underserved and unbanked populations. Banks should seize this opportunity to broaden their market reach and serve customer segments that were previously difficult to access due to geographical, economic, or logistical barriers. By leveraging digital platforms, mobile banking, and alternative lending models, banks can offer essential financial services—such as savings accounts, loans, and insurance—to individuals who may not have had access to traditional banking services.

Digital technologies enable banks to bypass the need for physical branches, allowing them to reach remote or rural areas were setting up traditional infrastructure would be cost-prohibitive. Moreover, FinTech solutions such as mobile wallets and microloans provide an opportunity to offer tailored financial products that align with the unique needs of underserved populations. For example, mobile banking can enable low-income individuals to make payments, transfer funds, and access credit, all from their smartphones, creating a more inclusive financial ecosystem.

Furthermore, FinTech can reduce the costs and complexities associated with traditional banking services, making financial inclusion more accessible to those with limited financial resources. By leveraging data-driven credit scoring models, banks can offer credit to individuals without conventional credit histories, helping them to establish financial identities and access necessary funding for personal and entrepreneurial growth.

By promoting financial inclusion through FinTech, banks can not only improve social equity but also tap into new markets, leading to expanded customer bases and potential for growth. This approach can contribute to the broader goal of sustainable economic development, providing individuals and communities with the financial tools they need to thrive. Through innovation and commitment to inclusivity, banks can help bridge the financial gap and foster a more inclusive global economy.

- **Recommendations of the Policymakers and Regulator**
  - **Enhance Regulatory Support for FinTech Adoption**

    Policymakers should prioritize the establishment of a regulatory framework that fosters the adoption of FinTech within the banking sector. A well-designed regulatory environment can encourage innovation by allowing banks to explore and integrate advanced digital technologies that enhance operational efficiency, reduce costs, and improve competitiveness. By creating regulations that are flexible yet comprehensive, policymakers can enable banks to leverage FinTech solutions—such as artificial intelligence, blockchain, and data analytics—while maintaining the stability of the financial system.

    This regulatory framework should promote innovation without compromising on oversight. Regulations must ensure that banks adopt FinTech solutions responsibly, addressing any potential risks posed by digital technologies, such as data privacy concerns, cybersecurity threats, and the possibility of market disruptions. To achieve this, policymakers can implement adaptive regulatory mechanisms that can evolve alongside technological advancements, enabling the financial system to remain resilient while benefiting from innovation.

In addition, the regulatory environment should foster collaboration between banks, FinTech firms, and regulatory bodies. This can be done through initiatives like regulatory sandboxes, where banks can test FinTech solutions in a controlled environment, ensuring compliance with legal and regulatory standards before full-scale implementation. Such collaborative efforts would help identify and mitigate any risks associated with the integration of FinTech solutions and promote a culture of continuous improvement in the sector.

Ultimately, a balanced regulatory framework will support the growth and integration of FinTech while safeguarding the financial system from potential vulnerabilities. By encouraging banks to adopt digital solutions that enhance efficiency and competitiveness, regulators can help create a more dynamic, secure, and resilient banking sector, positioning it for long-term success in an increasingly digital world.

FinTech can play a transformative role in expanding financial inclusion by delivering digital banking services to underserved populations. Banks should seize this opportunity to broaden their market reach and target segments that were previously difficult to access.

- **Raise Awareness of FinTech Benefits**

  Policymakers and regulators should actively conduct awareness campaigns to educate the public about the numerous benefits of digital banking and FinTech solutions. These campaigns can take the form of workshops, advertisements, community outreach programs, and public service initiatives that highlight how digital banking can improve convenience, reduce costs, and enhance financial accessibility. By informing the public about the advantages of FinTech, such as faster transactions, improved financial management tools, and greater financial inclusion, these efforts can help build trust in digital platforms and encourage broader adoption.

  Awareness campaigns should also focus on educating consumers about the security measures in place to protect their data and financial transactions, addressing any concerns about fraud or digital risks. Providing clear, easily understandable information about the safety features of FinTech platforms can

help alleviate skepticism and increase confidence in using digital banking services.

In addition to fostering trust, these campaigns should aim to showcase real-life success stories of individuals or communities that have benefited from FinTech, particularly those who previously lacked access to traditional banking services. Demonstrating tangible impacts can motivate individuals to explore digital solutions and encourage them to take the first step toward embracing FinTech.

Ultimately, raising awareness about the benefits of FinTech is key to accelerating its adoption across diverse demographic groups. With increased public knowledge and trust, more people will be inclined to adopt digital banking services, leading to greater financial inclusion and empowerment. Through targeted education and outreach efforts, policymakers and regulators can create a foundation for widespread FinTech adoption, fostering innovation and progress in the financial sector.

- **Recommendations of the Consumers and End-Users**

Consumers should actively increase their knowledge and understanding of financial technology (FinTech) and the various tools used by banks to enhance their services. By familiarizing themselves with the benefits and features of FinTech solutions—such as mobile banking apps, digital wallets, and automated financial tools—users can make informed decisions about their financial management. Understanding how these technologies can improve convenience, lower costs, and enhance financial access will enable consumers to take full advantage of the offerings provided by digital banking platforms.

Moreover, consumers should consider choosing banks that promote and integrate FinTech into their operations. By selecting banks that prioritize innovation and customer-centric digital solutions, users can benefit from enhanced services such as real-time financial advice, personalized loan options, and more secure, efficient transactions. Supporting banks that adopt FinTech solutions not only helps consumers access better services but also encourages further innovation and

competition within the financial sector, leading to the continued development of more advanced, accessible, and affordable financial products.

Ultimately, by increasing their knowledge of FinTech and supporting banks that embrace digital transformation, consumers can improve their financial well-being, gain better control over their finances, and contribute to the growth of the digital economy. This proactive approach to engaging with FinTech will help users stay ahead in an increasingly technology-driven financial landscape.

5.4 Future Research Directions

The findings of this study provide a valuable framework for analyzing FinTech adoption in other developing economies. Future research can build on these insights by exploring several key areas:

- **Comparative Studies:** Comparative research between Palestine and other developing economies could offer valuable insights into the contextual factors that either drive or hinder FinTech adoption. These studies could explore how different regulatory environments, cultural attitudes, and economic conditions shape the effectiveness and acceptance of FinTech. This could provide broader generalizations about FinTech adoption in similar socio-economic contexts and inform more tailored strategies for different regions.
- **Longitudinal Studies:** A longitudinal approach would be beneficial in capturing the long-term impacts of FinTech adoption on both competitiveness and financial performance. By following the evolution of FinTech adoption over time, researchers can observe how its integration into the banking system and pricing strategies.
- **Addressing Sector-Wide Challenges to FinTech Adoption:** This could involve examining sector-wide barriers, such as regulatory constraints, infrastructure limitations, and market readiness, which may hinder the broader adoption of FinTech solutions. Identifying these challenges will help policymakers and banks address these gaps, creating a more conducive environment for FinTech at the sector level.
- **Customer Behavior and Perception Studies:** Understanding customer attitudes and behaviors is critical to the successful adoption of FinTech. Future research should explore how different customer segments perceive and interact with FinTech solutions. This could involve studying the factors that influence customer trust in digital platforms, the adoption rate of FinTech products, and how customer satisfaction correlates with technological features. By doing so, banks can design more customer-centric technologies that are better aligned with customer needs, driving higher adoption rates and improving user experiences.

- **Broader Metrics:** Future research could expand the scope of metrics beyond the traditional indicators. Researchers could explore metrics such as digital transaction volumes, customer satisfaction, brand loyalty, and the effectiveness of customer support systems. These broader metrics would provide a more comprehensive view of FinTech's impact on banks, helping stakeholders understand how FinTech not only influences financial performance but also enhances customer engagement and loyalty, which are crucial for long-term success.

By exploring these areas, future research can further refine the understanding of how FinTech adoption shapes the banking sector, particularly in developing economies, and provide actionable insights to guide future innovation and policy development.

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ضرورة التكنولوجيا المالية للبنوك: المواءمة بين القدرة التنافسية والأداء

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الاستاذ الدكتور زهران دراغمة

ملخص

تستكشف هذه الدراسة مدى تأثير تبني التكنولوجيا المالية على القدرة التنافسية والأداء المالي للبنوك. اعتمدت الدراسة على البيانات المتوفرة لجميع البنوك العاملة في فلسطين، بما في ذلك البنوك المدرجة وغير المدرجة المسجلة لدى سلطة النقد الفلسطينية خلال الأعوام 2015 و2022. تطبق الدراسة منهجية سطح الاستجابة لاستكشاف العلاقة بين مستوى تبني التكنولوجيا المالية ومؤشرات التنافسية والأداء المالي المختلفة المتعلقة بالبنوك. تعد منهجية سطح الاستجابة مناسبة بشكل خاص لنمذجة وتحليل العلاقات غير الخطية، حيث تستخدم نماذج الانحدار المتعدد لتقريب سطح الاستجابة. توفر هذه المنهجية تمثيلاً أكثر مرونة ودقة للتفاعلات الكامنة بين المتغيرات، مما يوفر مزايا كبيرة مقارنة بالنماذج الخطية التقليدية في التعبير عن الأنماط المعقدة.

تم استخدام المتغير المستقل نسبة الأصول التكنولوجية كمؤشر على مستوى تبني التكنولوجيا المالية مقارنة مع عدة متغيرات تابعة، بما في ذلك نسبة التكلفة إلى الدخل والحصة السوقية للبنك من التسهيلات الائتمانية كمقاييس للقدرة التنافسية للبنوك، والعائد على حقوق الملكية وصافي هامش الفائدة كمؤشرات للأداء المالي للبنوك. تشير النتائج إلى أن هناك علاقة ذات دلالة إحصائية بين نسبة الأصول التكنولوجية ونسبة التكلفة إلى الدخل والحصة السوقية للبنك من التسهيلات الائتمانية، والعائد على حقوق الملكية، حيث إن قيم p أقل من عتبة 0.05، مما يشير إلى علاقة إيجابية قوية. ومع ذلك، أشار التحليل إلى أنه لا يوجد علاقة ذات دلالة إحصائية بين نسبة الأصول التكنولوجية وصافي هامش الفائدة، حيث كانت قيم p أكبر من 0.05.

استنادًا إلى هذه النتائج، توصي الدراسة بأن تستمر البنوك في الاستثمار في حلول التكنولوجيا المالية لتعزيز الكفاءة التشغيلية وتحسين إدارة محفظة القروض، خاصة في ضوء التأثير الإيجابي لارتفاع نسبة الأصول التكنولوجية في تعزيز نسبة التكلفة إلى الدخل والحصة السوقية للبنك من التسهيلات الائتمانية والعائد على حقوق الملكية. علاوة على ذلك، يجب أن تركز البنوك على الاستفادة من

التكنولوجيا المالية في تسعير المنتجات والخدمات الخاصة بها، في ضوء عدم وجود تأثير بين نسبة الأصول التكنولوجية وصافي هامش الفائدة لدى البنوك العاملة في فلسطين. كذلك أوصت الدراسة صانعي السياسات بتعزيز الأطر التنظيمية لدعم تبني التكنولوجيا المالية، مما يضمن بيئة ملائمة للابتكار والنمو في القطاع المصرفي.

وأخيرًا، يجب أن يأخذ البحث المستقبلي في الاعتبار الدراسات المقارنة والطولية لتقييم التحديات والفرص على مستوى القطاع المتعلقة بدمج التكنولوجيا المالية. يمكن أن توفر هذه الأساليب البحثية رؤى أعمق حول ديناميكيات اعتماد التكنولوجيا المالية ودمجها في سياقات مختلفة، مما يكشف عن وجهات نظر أكثر دقة. ستوفر مثل هذه الدراسات إرشادات قيمة لصانعي السياسات، ومديري البنوك، ومطوري التكنولوجيا، لمساعدتهم على مواجهة التحديات المتطورة والاستفادة من الفرص التي تقدمها التكنولوجيا المالية في القطاع المصرفي.

الكلمات المفتاحية :التكنولوجيا المالية، القدرة التنافسية للبنوك، الأداء المالي للبنوك، منهجية سطح الاستجابة.