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The Impact of Investment in Technology on the Profitability of Jordanian Commercial Banks: The Mediating Role of Non-Performing Loans (NPL)

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أثر الاستثمار في التكنولوجيا على ربحية البنوك التجارية الأردنية: الدور الوسيط للقروض المتعثرة

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قدّمت هذه الرسالة استكمالًا لمتطلّبات الحصول على درجة الماجستير في تخصّص المحاسبة في جامعة الشرق الأوسط

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Thesis Committee Decision

This thesis titled **"The Impact of Investment in Technology on the Profitability of Jordanian Commercial Banks: The Mediating Role of Non-Performing Loans (NPL). Applied Study on Jordanian Commercial Banks"**, has been defended, accepted, and approved. On 22/1/2025

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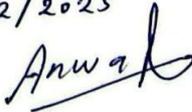
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Dedication

This Master's thesis is dedicated to all those who supported me throughout this journey.

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Researcher

Anwar Ramadan

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The Impact of Investment in Technology on the Profitability of Jordanian Commercial Banks: The Mediating Role of Non-Performing Loans (NPL)

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Abstract

This study aims to find out the impact of investment in technology on the profitability of 13 Jordanian commercial banks listed in the Amman Stock Exchange (ASE); according to the Central Bank of Jordan, there are 20 licensed banks in Jordan; the study used Net Interest Margin (NIM), Return on Assets (ROA) and Return on Equity (ROE) as key measures of banks profitability and efficiency in managing its interest-earning assets and interest-bearing liabilities. The bank's portfolio allocation mix should prioritize loan classes that create income, as a large number of these loans often become non-performing and provide no income.(Thakur et al. 2023). This requires a careful portfolio mix and business and client analysis. This study is empirical research, utilizing data obtained from secondary sources, specifically annual financial reports. This study has examined data from audited annual financial statements spanning 2010 to 2020, along with key financial ratios and indicators utilized to evaluate the hypothesis. The study concludes that improving profitability in banks requires increased investment in technology to manage non-performing loans effectively. Improved AI applications can enable better monitoring of borrower behavior, more accurate risk assessment, and faster prediction of potential loan defaults. This proactive approach could help lower NPL rates, and enhance the financial stability and overall performance of banks Based on the above results, the study is significant for policymakers, decision-makers, regulators and commercial banks. It recommends that Jordanian commercial banks are encouraged to adopt effective practices for evaluating and managing credit risk to minimize NPLs. For future studies, it is important to look at the effects of artificial intelligence (AI) because it changes quickly. We should also examine how technology investment affects financial risks and operational performance.

Keywords: Non-Performing Loans (NPLs), Profitability, Net Interest Margin (NIM)

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الملخص

تهدف الدراسة إلى معرفة أثر الاستثمار في التكنولوجيا على ربحية 13 بنكًا تجاريًا أردنيًا مدرجًا في بورصة عمان (ASE)؛ يوجد 20 بنكًا مرخصًا في الأردن، وفقًا للبنك المركزي الأردني؛ وبالتالي، استخدمت الدراسة هامش صافي الفائدة (NIM) والعائد على الأصول (ROA) والعائد على حقوق الملكية (ROE) كمقاييس رئيسية لربحية المؤسسة المالية وكفاءتها في إدارة أصولها . يجب التركيز على لأولوية لفئات القروض التي تولد الدخل، حيث أن عددًا كبيرًا من القروض غالبًا ما تصبح متعثرة ولا توفر أي دخل. وهذا يتطلب مزيجًا دقيقًا في سلة قروض محافظ البنوك وتحليل الأعمال والعملاء بشكل دقيق قبل منح القرض . تعتبر هذه الدراسة تجريبية من حيث نوعها، ، حيث تم استخدام بيانات مستمدة من مصادر ثانوية، وتحديدًا التقارير المالية السنوية. وقد فحصت هذه الدراسة البيانات من القوائم المالية السنوية المدققة التي تمتد من عام 2010 إلى عام 2020، بالإضافة الى النسب والمؤشرات المالية الرئيسية لفحص صواب فرضيات هذه الدراسة. وخلصت الدراسة إلى أن تحسين الربحية في البنوك يتطلب زيادة الاستثمار في التكنولوجيا لإدارة القروض المتعثرة بشكل فعال. حيث يمكن لتطبيقات الذكاء الاصطناعي المحسنة من مراقبة أفضل لسلوك المقترض، وتقييم المخاطر بشكل أكثر دقة، والتنبؤ بشكل أسرع بالتخلف المحتمل عن سداد القروض. ويمكن أن يساعد هذا النهج الاستباقي في خفض معدلات القروض المتعثرة، وتعزيز الاستقرار المالي والأداء العام للبنوك. وبناءً على النتائج المذكورة أعلاه، توصي الدراسة بتشجيع البنوك التجارية الأردنية على تبني ممارسات فعالة لتقييم وإدارة مخاطر الائتمان لتقليل القروض المتعثرة. وبالنسبة للدراسات المستقبلية، ممكن البحث في آثار الذكاء الاصطناعي على القطاع المصرفي لأنه سريع التغيير والتطوير . ويمكن أيضًا دراسة كيفية تأثير الاستثمار في التكنولوجيا على المخاطر المالية والأداء التشغيلي.

الكلمات المفتاحية: القروض المتعثرة، الربحية، صافي هامش الفائدة، البنوك التجارية

Chapter One

Study Background and Significance

1.1 Study Background

Introduction

The evolution of technology in the financial sector is a fascinating journey that we need to explore. It all began in 1945 when payment with checks was firstly introduced, as highlighted in the FinTech Report (2023). followed by the credit card by the Bank of America in 1958 (FinTech Report, 2023) and the subsequent emergence of ATMs in 1967; the introduction of debit cards as transaction tools came later. the arrival of the Internet in the 1990s, paving the way for Internet banking services. The 2000s witnessed further advancements in FinTech, including the rise of mobile payments and crowdfunding; as noted by Kanoujiya et al. (2021), Technology, competitive advantage, and sustainability initiatives are not just crucial, but they are the backbone of any successful bank. The bank ensures sustainability and transparency in its services by using cutting-edge technologies and embracing them for monitoring and enhancement. Focusing on technology not only assures us about the industry's future but also instils confidence in its commitment to delivering the best services.

The impact of Technology investments on bank profitability has long been a topic of debate among scholars and policymakers (Mashal, A. 2006). For a while, there was no conclusive evidence that banks substantial spending on technology improved profitability, which gave rise to the term "Technology Profitability Paradox". Many recent studies, including those by Al-Amarneh (2023), Entele (2021), Adane et al. (2021), Wen et al. (2021), Del Gaudio et al. (2021), and Wang et al. (2021), have supported the idea that technology implementation is advantageous for a bank's profitability.

As stated by Cicchiello et al. (2021), incorporating technology into the banking system has been associated with higher bank stock returns and enhanced Credit Default Swaps (CDS). The banking sector in Jordan is the backbone of the nation's economy. (World Bank. 2023). Like others, it is an integral part of financial systems. It affects the country's economy by providing financial services such as investment, credit facilities, deposits, and other financial services (Gaur and Mohapatra 2021). With the enhancements in IT Technology infrastructure, modern banking in Jordan delivers financial services. Hence, banks are notably contributing to rural development. Thus, the banking sector plays a role in the country's economic development. By now, Jordanian banking structure has grown by leaps and bounds. That is why it becomes essential to understand the different factors that may affect banks.

Net Interest Margin (NIM) is a financial metric that reflects the difference between the interest income earned from loans, mortgages and investment securities provided to customers and the interest expense paid on deposits from depositors. It is a key indicator of a financial institution's profitability and efficiency in managing its interest-earning assets and interest-bearing liabilities. A higher positive difference signifies greater profitability for the bank, while a negative value indicates inefficiency. As the bank's portfolio is distributed, loan types that bring in money should be given top consideration, since a large amount of these loans go into failure, the banks label them as non-performing loans (NPL). In this situation, it is very important to carefully look at both the customers and the companies, as well as the investments that are made. (Thakur et al. 2023).

This paper conducts a thorough examination of how technology investment (independent variables) impacts the profitability (dependent variable) of commercial banks in Jordan. It also examines non-performing loans as a mediating factor in this

complex relationship. It explores various technological advancements such as online banking, mobile applications, and automated services, and their impacts on bank profitability and overall financial performance within the banking sector. The analysis aims to provide insights into the relationship between technological integration and profit margins, highlighting both opportunities and challenges faced by these financial institutions in a rapidly evolving digital landscape.

1.2 Problem Statement

Over the past few years, the banking industry in Jordan has experienced notable expansion and success; developments in technology have greatly helped to explain this development. (Association of Banks in Jordan, 2023). This explosion of technical innovation has then heightened industry competitiveness. In such a very competitive and IT-intensive market, knowing the impact of information technology (IT) expenditures on profitability has become increasingly vital, especially in areas where the banking sector is fast changing, such as Jordan Banks and the larger Arab world. (AL-JABRI, 2023)

Not only a trend but also a strategic need that could affect financial results is the integration of technology inside banking operations (Al-Smadi, 2019).

This research looks at the link between technology spending and profitability of Jordan's commercial banks. It is important to understand that a big part of Jordan's economy depends on banks. It's not always clear what the link is between investing in technology and increasing profitability. Non-performing loans (NPL) are very important because they can have a big impact on a bank's ability to stay financially stable.

Previous research hasn't looked into how loans that aren't being paid back affect the relationship between investing in technology and the profitability of Jordanian banks (Al-

Amarneh, A. et.al, 2023). The goal of this study is to look at how the increase in profit of commercial banks in Jordan compared to the increase in technology spending. It also looks at how the Non-Performing Loans play as a mediator in this relation.

Through exploring this subject, the study intends to offer insightful analysis for bankers as well as researchers. It will demonstrate how technology solutions could increase profitability while lowering non-performance loan. Given the increasing competitiveness among Arab country's banks, where they constantly innovate to keep a competitive edge, this study is very crucial.

Knowing the complex relationship between IT investments, NPL and profitability will enable banks in Jordan to create better plans to develop more effective strategies to navigate this challenging landscape (Al-Smadi, 2019).

1.3 Significance of the Study

Studies on whether investing in information technology (IT) increases a bank's profitability have generated conflicting findings. The argument on whether banks really gain from their IT expenditures is still in progress (Ugwuanyi et al., 2013). This circumstance emphasizes the need of closely examining banking sector profitability.

Del Gaudio et al. (2021) investigated 28 EU banks, looking at how technology influences bank profitability between 1995 and 2015. Their results confirm past studies demonstrating that technology raises the profitability of a bank. Al-Amarneh (2023) also concurs that technology enables a bank to turn around its profitability.

This paper seeks to give a thorough knowledge of how technological investments affect the profitability of Jordanian commercial banks. It particularly looks at how non-performing loans (NPL) could mediate in this relationship. Examining the complex

dynamics of technology investments, profitability, and the impact of non-performing loans within the framework of Jordanian banking, the paper helps academics, business leaders, and legislators by providing a comprehensive road map to understand and evaluate the wide range of studies on how technology investment impacts profitability.

1.4 Research Objectives

This Study Aims to Achieve the Following Objectives:

- Exploring the Impact of Investment in Technology on Jordanian Commercial Banks' Profitability.

- Exploring the Impact of Non-Performing Loans on Jordanian Commercial Banks' Profitability.

- Exploring the Impact of Investment in Technology on Non-Performing Loans.

- Exploring the Impact of Investment in Technology on Jordanian Commercial Banks' Profitability, Considering the Mediating Impact of Non-Performing Loans.

1.5 Research Questions and Hypotheses

This study aims to answer the following main questions:

1) **Does investment in technology impact the profitability of Jordan's Commercial Banks?**

By answering the following sub questions :

- What is the impact of investment in technology on the net interest margin (NIM) of commercial banks in Jordan?

- What is the impact of investment in technology on the return on assets (ROA) of commercial banks in Jordan?

- What is the impact of investment in technology on the return on Equity (ROE) of commercial banks in Jordan?

2) **Does Non-Performing Loans impact the profitability of Jordan's Commercial Banks?**

- What is the impact of Non-Performing Loans on the net interest margin (NIM) of commercial banks in Jordan?

- What is the impact of Non-Performing Loans on the return on assets (ROA) of commercial banks in Jordan?

- What is the impact of Non-Performing Loans on the return on Equity (ROE) of commercial banks in Jordan?

3) **How does investment in technology impact Non-Performing Loans?**

4) **How does investment in technology impact the Jordanian Commercial Banks' Profitability, Considering the Mediating Impact of Non-Performing Loans?**

By answering the following sub-questions :

- What is the impact of investment in technology on the net interest margin (NIM) of commercial banks in Jordan Considering the Mediating Impact of Non-Performing Loans?

- What is the impact of investment in technology on the return on assets (ROA) of commercial banks in Jordan, considering the Mediating Impact of Non-Performing Loans?

- What is the impact of investment in technology on the return on equity (ROE) of commercial banks in Jordan, Considering the Mediating Impact of Non-Performing Loans?

1.6 Study Hypothesis

In light of the study problem and its questions, the following hypotheses can be formulated:

The first primary hypothesis

H01: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks.

The subsequent sub-hypotheses arise from the first primary hypothesis, which is grounded on the components of profitability.

H01-1: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

H01-2: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).

H01-3: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return On Equity (ROE).

The second primary hypothesis

H02: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks.

The subsequent sub-hypotheses arise from the second primary hypothesis, which is grounded on the components of profitability.

H02-1: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

H02-2: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).

H02-3: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Equity (ROE).

H03: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in technology on the Non-Performing Loans.

H04: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks Considering the Mediating Impact of Non-Performing Loans.

The subsequent sub-hypotheses arise from the fourth primary hypothesis, which is grounded on the components of profitability.

H04-1: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks

measured by Net Interest Margin (NIM) Considering the Mediating Impact of Non-Performing Loans.

H04-2: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return on assets (ROA) Considering the Mediating Impact of Non-Performing Loans.

H04-3: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return on equity (ROE) Considering the Mediating Impact of Non-Performing Loans.

1.7 Conceptual and Operational Definitions

When defining key terms for the study on "The Impact of Investment in Technology on the Profitability of Jordanian Commercial Banks: The Mediating Role of Non-Performing Loans (NPL)", it's essential to distinguish between conceptual definitions (theoretical meaning) and operational definitions (how variables are measured or observed).

Investment in Technology

Conceptual Definition: Investment in technology refers to the allocation of financial and human resources by commercial banks towards the adoption, implementation, and maintenance of technological tools, systems, and infrastructure aimed at enhancing banking operations, efficiency, and customer service. (Teece, 2018).

Operational Definition: This is measured as the total amount of capital expenditure allocated to technological assets such as software, hardware, digital platforms, and cybersecurity systems. the banks' financial statements could contain measures such as the percentage of the bank's expenditure dedicated to technology, the

number of new technology initiatives launched, or qualitative assessments of the extent of digital transformation activities. (Teece, 2018).

Profitability of Commercial Banks

Conceptual Definition: it measures the commercial bank's ability to generate earnings in relation to its expenses and other relevant costs over a specific period. It is important to evaluate the bank's competitive position and financial health in the banking sector. (Berger and Humphrey, 1997).

Operational Definition: It is a method that employs a variety of financial ratios to determine a bank's profitability. Examples Profit Margin, Net Interest Margin (NIM), Return on Equity (ROE), and Return on Assets (ROA) (Goddard et al., 2004). The bank's financial statements, which are accessible on the Amman Stock Exchange website, contain these ratios, including income statements and balance sheets.

Non-Performing Loans (NPLs)

Conceptual Definition: Non-performing loans (NPLs) are loans for which the borrower fails to redeem any principle or pay interest. NPLs are a critical metric for evaluating a bank's financial health, as they serve as an indicator of the risk associated with the bank's loan portfolio. (Makri et al., 2014).

Operational Definition: NPLs can be measured as the ratio of non-performing loans to total loans (NPL ratio), which is frequently stated in percentage form. (Espinosa and Prasad, 2010). A loan is often categorized as non-performing when interest and principal payments are 90 days or more overdue or when repayment is deemed unlikely. (Makri et al., 2014).

Mediating Role of NPLs

Conceptual Definition: Non-performing loans (NPLs) influence how commercial banks spend on technology is related to the bank's profitability. Their presence or level can influence the effects of technology spending on a bank's profitability. This indicates that NPLs can either reduce or increase the impact of technology investments on profitability. (Makri et al. 2014).

Operational Definition: This could be assessed by conducting statistical analyses, such as regression analysis, where the NPL ratio is included as an interaction term. (Aiken & West, 1991) The Mediating impact would be evaluated by examining how the relationship between technology investment (independent variable) and profitability (dependent variable) changes at different levels of NPLs.

By clearly defining these concepts both conceptually and operationally, this study will have a solid framework for analysis and interpretation of results.

1.8 Study Scope

The study covers 13 conventional commercial banks working in the Jordanian economy. The data collected from the Amman Stock Exchange official website, which systematically classifies the total number of banks into different categories. The study period covers 11 years, from 2010 to 2020.

1.9 Study Limitations

- Technological Variability: The type and extent of technology investments might vary significantly across banks, making it challenging to standardize and compare the impact.

- External Economic Factors: Economic conditions in Jordan, such as inflation, interest rates, and political stability, could influence bank profitability and NPLs, confounding the impacts of technology investments.

- The Impact of the COVID-19 Pandemic: The study period was limited to the period from 2010 to 2020 due to the increased reliance of banks on technology during the pandemic to provide banking services to their customers remotely.

- Measurement Challenges: Different banks might use different accounting methods, which could affect profitability metrics. Such as fair value accounting or historical cost accounting, which can significantly influence the perceived profitability metrics.

- Causal Relationships: Establishing a causal relationship between technology investments and profitability, with NPLs as a mediating, may be difficult. The study might only demonstrate correlation rather than causation.

- Technological Change: Rapid technological changes could quickly make the findings outdated. The study might not account for new technological advancements or shifts in banking practices.

- Generalizability: The findings from Jordan's commercial banks might not apply to banks in other countries with different economic, regulatory, and technological environments.

- IFRS 9 implication effective 1 January 2018, with early application permitted. IFRS 9 specifies how an entity should classify and measure financial assets, financial liabilities, and some contracts to buy or sell non-financial items.

Addressing these limitations in the study design, analysis, and discussion sections will help provide a clearer understanding of the study's scope and the context.

Chapter Two

Theoretical Framework and Previous Studies

Introduction

The components of technical investment that promote innovation in the banking sector are the focus of this chapter. Additionally, the report investigates the factors that affect a bank's profitability, such as the Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM). The chapter also discusses the factors that influence the relationship between technology investment and profitability, as well as Non-Performing Loans (NPLs).

The literature review examines the intricate relationship between banks' profitability and their adoption of new technologies. Significant findings indicate that investing in technologies such as ICT infrastructure, FinTech, the Internet of Things (IoT), and blockchain can enhance operational efficiency and substantially increase employee productivity. (Scott et al. 2017), (Adane et al. 2021) and (Wang et al. (2021), Better technology management can make it easier to handle financial products and services, which could lead to more revenue and profits. (Adeabah et al. 2021), (Wen et al. 2021) and (Del Gaudio et al. 2021). This part gives an overview of previous research and points out the ways in which this study is different from those earlier studies. Finally, it describes the research gap this study aims to fill.

2.1 Theoretical Framework

2.1.1 Investment in Technology

This variable shows the total capital outlay on integrated computer systems, hardware, software, and related expenses-including telecommunications, maintenance, and technical support. According to Teece (2018), Investment in IT is seen as a crucial component in upgrading bank operations, enhancing customer service, and maintaining competitive advantage in the financial sector.

Technologies are driving innovation in the banking sector: The recent banking environment prioritizes using technology to enhance client experience, strengthen security systems, and simplify operational processes, so raising efficiency and profitability. (Adane et al., 2021). This chapter lists several current and important technologies advancing banking sector innovation. These technologies include digital and mobile banking as well as artificial intelligence (AI) and machine learning (ML).

Digital and Mobile Banking Expansion

To provide more comprehensive, user-friendly, and secure services, banks are continually enhancing their digital banking platforms and mobile banking applications. This includes mobile check deposits, personalized financial insights, instantaneous notifications, and accessible payment options. (Khan & Asghar, 2022)

Artificial Intelligence (AI) and Machine Learning (ML)

Artificial intelligence (AI) and machine learning (ML) are strengthening the financial sector. These technologies improve the efficiency and efficacy of financial services. (Nguyen, P. D. 2024) They aid banks in improving essential domains, such as service personalization, fraud detection, risk management, and client assistance. Financial

institutions are progressively integrating these technologies to enhance their competitiveness and foster innovation in a swiftly changing financial environment.

A study by Huang and Rust (2021) explains how AI and ML impact many banking services. These technologies are transforming the industry, especially in personalized banking services, risk management, fraud detection, and customer support.

Blockchain technology

The financial world is changing because blockchain technology is solving important problems like security, speed, and transparency in transactions. It has the potential to make the user experience better and to make banking processes faster and safer (Nguyen, P. D. 2024). These benefits and the fact that it can work with other systems are pushing banks to use this technology. Also, blockchain technology can make the clearing and settlements much faster. In the past, these steps could take days to finish, mostly because they needed to be checked by a third party and reconciled in detail. With blockchain technology, they can be cut down to minutes or even seconds. Identity Verification: Blockchain technology makes the process of verifying identities faster and safer. By using a decentralized system to store and access protected personal information, blockchain can lower the risk of identity theft and fraud by making the verification processes that banks use more efficient. (Tapscott, 2016)

Cybersecurity Enhancements

As cyber threats continue to evolve, banks are investing heavily in advanced cybersecurity technologies to protect sensitive financial data. This includes advanced encryption methods, biometric security features, and AI-based anomaly detection systems. (Khan & Asghar, 2022).

Cloud Computing

Banks are moving more of their operations to the cloud to enhance flexibility, scalability, and cost-efficiency. Cloud solutions enable banks to deploy new services rapidly and enhance the resilience of their IT infrastructure. (Khan & Asghar, 2022).

APIs and Open Banking

Investment in Application Programming Interfaces APIs and open banking platforms is on the rise due to regulatory mandates and the push for innovation. These technologies allow third-party developers to build applications around the financial institution, increasing competitiveness and customer service options. (Khan & Asghar, 2022).

Sustainability Tech

As global awareness of environmental issues increases, banks are stepping up their investments in sustainability technology. This includes developing green finance products like sustainable bonds and loans, which fund environmentally friendly projects, and deploying advanced technologies to monitor and analyze the environmental impact of their operations. These technologies aid in assessing the sustainability performance of investments and help in reporting on environmental metrics. While these efforts are pivotal for promoting environmental stewardship and aligning with global sustainability goals, they also come with challenges such as significant initial investments and the need for rigorous standards and transparency in environmental impact reporting. (Schaltegger & Hörisch 2017)

Advanced Data Analytics

Big data analytics is crucial for gaining insights into customer behaviour, enhancing decision-making processes, and creating personalized marketing strategies. Banks are investing in sophisticated data analytics tools to harness the power of big data effectively. (Khan & Asghar, 2022).

Quantum Computing

Quantum computing is an advanced computing technology that operates on quantum-mechanical principles, utilizing quantum bits or qubits. (Gyongyosi, & Imre, 2019). Unlike traditional bits, which are either 0 or 1, qubits can exist in multiple states simultaneously due to superposition. This allows quantum computers to process vast amounts of data at unprecedented speeds. Entanglement, another quantum property, enables qubits to be interconnected in a way that the state of one directly influences others, enhancing computational efficiency. Quantum computing holds potential for revolutionary applications in fields such as cryptography, drug discovery, optimization tasks, and artificial intelligence. Though still in the early stages, some leading banks are exploring quantum computing's potential to transform areas such as encryption, complex financial modelling, and optimization problems. (Gyongyosi, & Imre, 2019).

The above-mentioned nine technologies reflect the banking industry's ongoing transformation as it adapts to technological advancements, regulatory changes, and evolving customer expectations.

2.1.2. Bank's Profitability

Bank profitability is an important indicator of a bank's performance, reflecting how effectively it operates within its environment (Athanasoglou et al., 2014). This term refers to a banking institution's ability to generate income that exceeds operational costs and other expenses, ultimately leading to financial profit. Profitability is a crucial measure of a bank's financial health and sustainability, demonstrating how well it manages its resources to create value for shareholders, customers, and the broader economy.

Sources of Bank Profitability

The sources of bank profitability can be summarized as follows: (Kenton, W. 2023).

Net Interest Income

- o **Definition:** The difference between the income a bank earns from interest on loans and securities and the interest it pays on deposits and borrowings.
- o **Importance:** This is the core of traditional banking profitability, where the spread between lending rates and deposit rates is a primary income source.

Non-Interest Income

- o **Definition:** Revenue generated from fees, commissions, trading, and other non-lending activities.
- o **Importance:** This component is crucial as it provides diversification in revenue streams, reducing reliance on interest income, especially in low-interest-rate environments.

Operational Efficiency

- o **Definition:** The ratio of running operation expenses to income, commonly known as the cost-to-income ratio.

o **Importance:** Banks that function efficiently—by effectively managing their costs in relation to their income—are generally more lucrative. Reduced operational expenses improve margins and profitability.

Asset Quality

o **Definition:** The quality of a bank's loan portfolio, particularly regarding the level of non-performing loans (NPLs).

o **Importance:** Poor asset quality, indicated by a high level of NPLs, leads to greater provisions for loan losses, which can significantly reduce profitability. Conversely, high asset quality supports sustained profitability.

Capital Adequacy

o **Definition:** The Capital Adequacy Ratio (CAR) and other metrics of a bank's capital reserves ensure that the organization can withstand prospective losses while remaining solvent.

o **Importance:** Banks with robust capital reserves are better able to weather economic disasters and expand their lending operations, both of which benefit their bottom line.

Market Conditions and Economic Environment

o **Definition:** External factors such as interest rates, economic growth, inflation, and market competition affect a bank's profitability. (Athanasoglou et al., 2014).

o **Importance:** favorable economic conditions, such as increasing interest rates or economic growth, can enhance bank profitability. However, adverse conditions, like a recession, can reduce it.

Regulatory Compliance

- o **Definition:** Adherence to banking regulations, norms, and standards that necessitate banks to uphold specific capital requirements and manage risks proficiently.

- o **Importance:** While compliance may elevate operating expenses, effectively managed regulatory adherence can reduce risks and improve long-term profitability by preventing fines, penalties, and reputational harm.

Significance of Bank Profitability

- **Sustainability:** Profitable banks are likely to remain sustainable over time. They can better handle economic downturns and invest in future growth**.** (Athanasoglou et al., 2014)

- **Shareholder Value:** Profitability is important because it affects the returns that shareholders receive, such as dividends and increases in share prices.

- **Financial Stability:** Profitable banks contribute to the overall stability of the financial system, as they are better equipped to manage risks and avoid insolvency.

- **Customer Trust:** A profitable bank is perceived as more reliable, attracting additional deposits and customers, which further enhances its profitability.

The profitability of a bank is a complex measure of its proficiency in managing revenue, costs, assets, and risks. In a volatile financial market, this profitability is essential for banks to remain operational, grow, and compete (Kenton, W. 2023)

Metrics to Measure Bank Profitability

These ratios are essential for evaluating bank profitability.

Net Interest Margin (NIM):

Net Interest Margin (NIM): is a key measure in banking, it shows the difference between the money banks earn from loans and mortgages and the money they pay to depositors in interest. NIM is an important sign of how well a bank manages its interest-earning assets and the money it owes. (Wall Street Prep, n.d.)

Net Interest Margin Formula: To calculate the net interest margin (NIM), you can use the following formula:

Net Interest Margin (NIM) = Net Interest Income (NII) ÷ Average Interest-Earning Assets

Where

Net Interest Income (NII) = Interest Income – Interest Expense

Return on Assets (ROA)

ROA is a profitability ratio that evaluates how effectively a bank uses its assets to generate net income. It reflects managerial efficiency in asset utilization and is often used to compare the financial performance of banks in managing their assets to generate income (Berger & Humphrey, 1997).

Understanding Return on Assets (ROA)

The return on assets ratio is commonly expressed as a percentage using a bank's net income and average assets. A higher ROA indicates that a bank is more efficient and productive at managing its balance sheet to generate profits, while a lower ROA suggests that there is room for improvement.

Bank-specific factors affecting profitability, as measured by return on assets (ROA) and return on equity (ROE), These factors include the size of the bank, the number of branches, the asset management ratio, operational efficiency, leverage ratio, liquidity ratio, and asset quality ratio.

Banks prioritize efficiency. Comparing profits to revenue is a useful operational metric; comparing them to the resources a bank used to earn them shows the feasibility of that bank's existence. Return on assets is the simplest of such corporate bang-for-the-buck measures. It tells you what earnings are generated from invested capital or assets.

ROA for public companies can vary substantially and is highly dependent on the industry in which they function. For example, the ROA for a tech company won't necessarily correspond to that of a food and beverage company.

This is why, when using ROA as a comparative measure, it is best to compare it against a bank's previous ROA numbers or a similar bank's ROA.

The ROA figure gives financial users an idea of how effective the bank is in converting the money it invests into net income. The higher the ROA number, the better, as it indicates that the bank is able to earn more money with a smaller investment. A higher Return on Assets (ROA) indicates greater efficiency in using assets.

Return on Equity (ROE)

Another important factor to look at is Return on Equity (ROE). It shows how well and profitably a bank uses its owners' money to make a profit. The ROE financial ratio is very important and valued by investors because it highlights the return on their invested capital. An increase in ROE indicates improved efficiency and profitability, which can attract more investment by demonstrating effective capital management. ROE is also

useful for comparing the performance of banks within the same sector or against the broader market. A higher ROE typically reflects a bank's superior ability to generate income without needing to increase capital proportionately. This underscores its operational effectiveness and strategic prowess in resource utilization.

2.1.3. Non-Performing Loans (NPLs):

Non-performing loans (NPLs) are essential for assessing a bank's financial health. They not only indicate the difficulties faced by individual borrowers but also provide insight into the overall risk and quality of the bank's assets. A high NPL ratio, which signifies a substantial number of loans in default, can greatly affect a bank's financial stability. They deplete revenue and capital reserves, necessitating higher loss provisions which reduce profitability and can degrade credit ratings. Effective management of NPLs is therefore essential to maintaining a bank's financial integrity and compliance with regulatory standards (Makri et al., 2014).

NONPERFORMING LOANS/TOTAL LOANS

8.20% 8.50% 7.70% 7% 5.6% 4.9% 4.3% 4.2% 4.9% 5.0% 5.5%

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
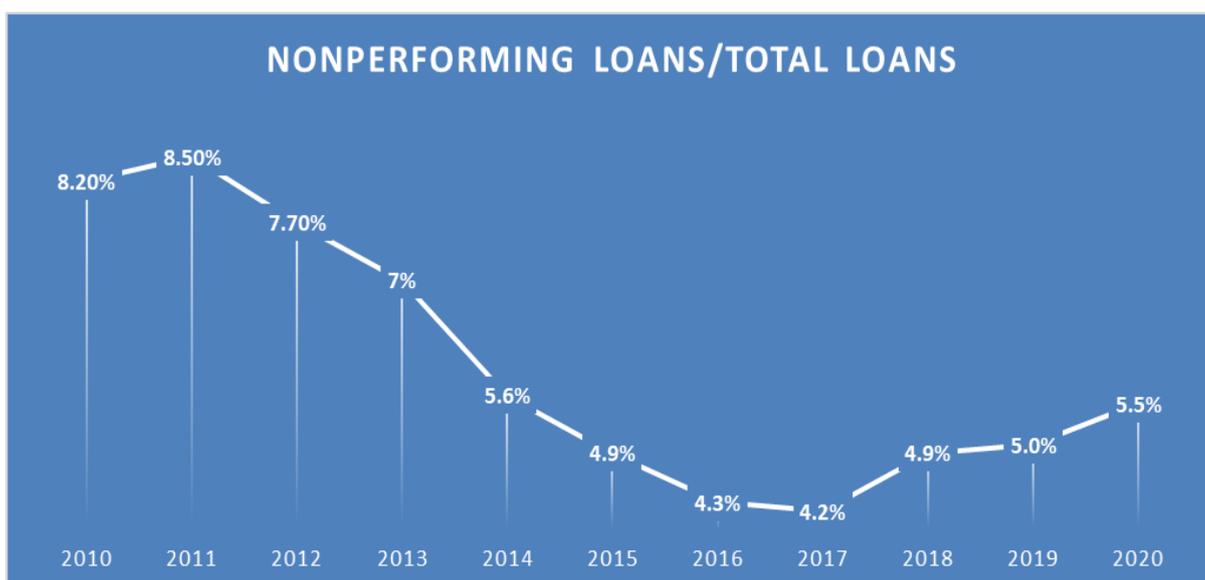
Chart 2.1.3 shows the percentage of non-performing loans out of total loans granted by the Jordanian banks over the years of 2010 till 2020.

The researcher created chart 2.1.3 based on data collected from The Central Bank of Jordan.

Source:https://www.cbj.gov.jo/ebv4.0/root_storage/ar/eb_list_page/smes32024.pdf

Cost-to-Income Ratio

Compares a bank's operating expenses to its operating income. A lower ratio indicates higher efficiency and, typically, higher profitability.

Efficiency Ratio

Similar to the cost-to-income ratio, it measures a bank's expenses as a percentage of its revenue. An efficiency ratio below 50% is generally considered good. (Kenton,2023).

2.1.4. Expected Relationships Between the Variables

The interaction between IT investment and financial performance metrics (NIM, ROA, ROE) is a focal point of analysis. Investment in IT is hypothesized to lead to enhanced operational efficiencies and improved customer satisfaction, which in turn could boost NIM through better margin management and cost controls. These improvements can cascade to better asset management and higher profitability, enhancing ROA and ROE and reflecting a more efficient and profitable operation (Scott et al. (2017), Teece, D. J. (2018), Adane et al. (2021), Del Gaudio et al. (2021), Entele (2021), Al-Amarneh (2023))

High levels of non-performing loans (NPLs) are generally considered harmful to the bank's financial health, as they can negatively affect return on assets (ROA) and return on equity (ROE) by increasing credit risks and associated costs. Appropriate information technology expenditures help to reduce these concerns. If banks enhance their risk assessment abilities, make their loan monitoring systems more effective, and strengthen the general credit management structure, they could be able to better control their credit risks (Nguyen, P. D. (2024), Zabin, S., Hossain, M. & Sultana, A. (2024)).

If a bank invests in IT, the net interest margin (NIM), return on assets (ROA), and return on equity (ROE) will most likely improve. High non-performing loans (NPLs) may, however, disguise these benefits slightly. By demonstrating how these parts are linked and how they affect a bank's overall financial performance, appropriately utilizing IT can help decrease the negative implications of NPLs.

2.1.5 Jordanian Banking Sector

The banking sector in Jordan is very important to Jordan's economic growth because it plays a vital role in Jordan's economic development, keeps the financial system stable, attracts investors, and drives innovation in financial services. Jordan's economy has been stable and growing for a long time thanks to the Central Bank of Jordan's management. according to the Central Bank of Jordan, there are 20 licensed banks in Jordan; The banking sector contributes 8.0% to the Gross Domestic Product (GDP), with every dinar spent generating about 1.5 dinars for the national economy directly and indirectly. (Association of Banks in Jordan. 2023) In Jordan, banks account for around 48% of the total market value of stocks listed on the Amman Stock Exchange.

When it comes to financial inclusion, the Central Bank of Jordan has implemented policies that have helped small and medium-sized businesses (SMEs) gain access to loans. This, in turn, has increased employment and GDP growth (CBJ, 2023).

Additionally, Jordan's financial infrastructure has been significantly enhanced by the banking sector. These investments in digital banking have improved accessibility and efficiency, in accordance with the global financial technology trends. According to the World Bank study, Jordan's banking sector has successfully incorporated technological advancements, resulting in a more equitable financial ecosystem. (World Bank, 2023).

Table (2.1.5) and Figure (2.1.5) represent the main performance indexes during the period from 2010 to 2020, showing a decrease in Non-Performing Loans as a percentage of total loans provided by Jordanian Commercial Banks rewarded by an increase in NIM as a percentage of the net income while the growth in total assets rewarded by a nearly stable return on assets.

Table (2.1.5): Jordanian Banking Sector performance indexes during the period from 2010-2020

Year	Non-Performing Loans / Total / Loans (%)	Return on Equity (ROE) (%)	Return on Assets (ROA) (%)	NIM/ Net Income (%)	Growth Rate in Total Assets (%)
2010	8.2 %	8.8 %	1.1 %	74.3 %	9.6 %
2011	8.5 %	8.3 %	1.1 %	70.1 %	7.9 %
2012	7.7 %	8.6 %	1.1 %	76.6 %	4.3 %
2013	7 %	9.9 %	1.2 %	77.6 %	9.1 %
2014	5.6 %	11 %	1.4 %	77.9 %	4.9 %
2015	4.9 %	10.3 %	1.3 %	77.4 %	5.08 %
2016	4.3 %	8.9 %	1.1 %	79 %	2.6 %
2017	4.2 %	9.1 %	1.2 %	75.8 %	1.62 %
2018	4.9 %	9.6 %	1.2 %	78.5 %	3.02 %
2019	5 %	9.44 %	1.18 %	77.6 %	5.4 %
2020	5.5 %	5.1 %	0.6 %	80.6 %	5.6 %

Source: Central Bank of Jordan Publications.
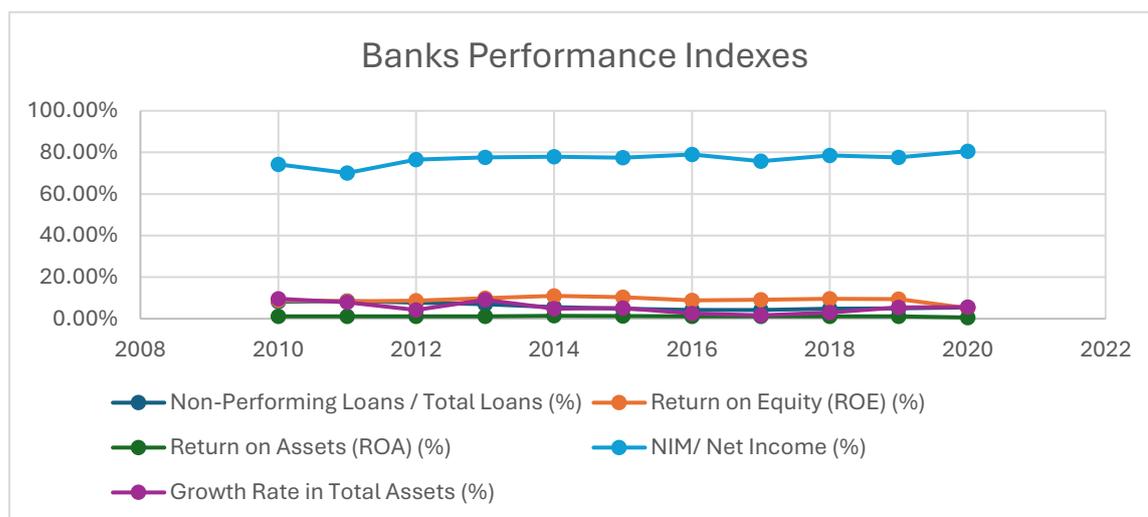
Figure (2.1.5) Performance of the Banking Sector from 2010 to 2020

The sector also contributes in attracting foreign direct investment (FDI) by maintaining a stable financial environment. This has strengthened Jordan's economic resilience while also establishing it as a regional financial center (World Bank, 2023).

2.2 Literature Review

Technology is a critical component of the banking industry, as it enhances operational efficiency and financial performance. Stakeholders and decision-makers should comprehend the profitability implications of banks' investments in information and communication technologies (ICT). This literature review condenses the primary findings of research on the correlation between technology deployment and bank profitability, with an emphasis on variables such as ROA, ROE, NIM, and NPLs. The review examines the impact of technology on profitability indicators and identifies factors influencing the relationship between technical investments and financial outcomes. A 25-year panel data analysis (1996-2019) (Wall Street Prep, n.d.) found that investing in technology services and human capital leads to significant organizational and economic growth. However, technology implementation frequently emphasizes IT infrastructure over staff training and development. Oversight can contribute to staff attrition and knowledge loss, especially in process-driven firms (Wall Street Prep, n.d.).

Several studies have explored how technology influences bank profitability. For instance:

Scott et al., (2017). The study title: The long-term effect of digital innovation on bank performance: An empirical study of SWIFT adoption in financial services.

The objective of the study was to investigate the long-term impact of SWIFT implementation on bank performance, focusing primarily on profitability. The research analyzed data from 6,858 banks across 29 nations. The study identified the adoption of SWIFT as the independent variable and bank performance, particularly profitability, as

the dependent variable. The results indicated that SWIFT implementation significantly enhances the profitability of smaller institutions; however, transaction costs necessitate a thorough cost-benefit analysis. Based on these findings, the study recommended that smaller institutions carefully evaluate whether to participate directly in SWIFT or operate indirectly, considering the balance between transaction costs and benefits. The key lesson learned is that while digital technologies like SWIFT can improve profitability for smaller institutions, achieving the most significant benefits depends on effective cost control.

Teece, D. J. (2018). The study title: Profiting from Innovation (PFI) in the digital economy: Enabling technologies, standards, and licensing models in the wireless world.

The objective of the study was to explore the impact of digital convergence, platforms, ecosystems, and enabling technologies on innovation, focusing on how intellectual property, complementary assets, standards, and business models drive value capture and profitability. The research analyzed data from four subsidiary companies of a Dutch bank while also addressing broader industry trends and frameworks. The independent variables included ICT access, complementary assets, standards, and licensing models, while the dependent variables were employee motivation, operational efficiency, revenue, and profitability. The results revealed that ICT access enhances employee motivation and efficiency, leading to increased revenue, though higher revenues do not always translate into higher profits due to tax frameworks and asset-related rebates. The study recommended further exploration of general-purpose technologies, licensing models, and the role of complementary assets to optimize value capture in digital platforms. A key lesson learned is that while innovation in digital platforms relies on a strong understanding of complementary assets and intellectual

property, effectively capturing value from enabling technologies presents complex strategic and policy challenges.

Wang, Xiuping, and Zhang. (2021). The study title: Can FinTech improve the efficiency of commercial banks? —An analysis based on big data.

The study aimed to examine whether FinTech enhances the operational efficiency of commercial banks in China, particularly in processing cross-border transactions and improving profitability. Data from Chinese commercial banks were analyzed using SYS-GMM and DFF-GMM regression methods. The independent variables were FinTech adoption and communication technology, while the dependent variables included bank operational efficiency and profitability. The results showed that FinTech significantly improves bank profitability by enabling efficient cross-border transactions and faster settlement times. The study recommended that banks strengthen their technology infrastructure and invest in employee training to enhance efficiency and attract more customers. A key lesson learned is that effective FinTech deployment, supported by robust technology infrastructure, leads to improved operational efficiency and profitability, providing a competitive edge in the banking sector.

Adeabah, Asongu, and Andoh. (2021). The study title: Remittances, ICT and Pension Income Coverage: The International Evidence. Technological Forecasting and Social Change.

The study aimed to explore the international effects of remittances, ICT, and pension income coverage across 96 countries using data collected from 2013 to 2015. The independent variables included remittances (as a percentage of GDP) and ICT (measured by mobile phone and internet penetration rates), while the dependent variable was pension income coverage, defined as the percentage of the population aged 60 and above with pension coverage. The results showed that ICT initially enhances pension coverage, but beyond certain thresholds,

further increases in ICT penetration lead to reduced pension coverage. Optimal thresholds for mobile phone and internet penetration were identified. The study recommended strategic investment in ICT to improve pension income coverage while cautioning against exceeding optimal thresholds to avoid diminishing returns. A key lesson learned is that while ICT and remittances positively influence pension systems, careful management of ICT investments is essential to maintain efficiency and effectiveness.

Del Gaudio et al. (2021). The study title: How do mobile, internet and ICT diffusion affect the banking industry?

The study aimed to investigate how the diffusion and adoption of ICT, including infrastructure such as ATM penetration, influence the profitability and stability of the banking sector. Using yearly data from 28 European countries between 1995 and 2015, sourced from the World Development Indicators, the study analyzed ICT diffusion (e.g., ATM penetration) as the independent variable and bank profitability and risk/stability as the dependent variables. The results revealed that ICT adoption positively affects bank profitability and stability, though managing the balance between higher revenues and financial stability remains a challenge. The study recommended that banks invest in ICT while maintaining regulatory compliance to ensure profitability without compromising stability. A key lesson learned is that while ICT diffusion can enhance profitability in the banking sector, it must be carefully managed to mitigate potential risks.

Wen et al. (2021). The article title: Big Data Driven Internet of Things for Credit Evaluation and Early Warning in Finance

The study aims to develop a credit risk assessment and early warning model using big data and machine learning algorithms for the Internet of Things (IoT) financial industry. It utilizes bank card and transaction data collected through customized web

crawlers from the IoT financial sector. The independent variables consist of 26 IoT financial indicators, while the dependent variable is credit risk classification. The results indicate that a random forest model optimized by the particle swarm algorithm significantly reduces credit risk misjudgment rates, thereby enhancing financial credit assessments. The study recommends further optimization of machine learning techniques to improve credit risk evaluations, enabling financial institutions to increase profitability while minimizing credit risk losses.

Adane et al. (2021). The study title: Determinants of automated teller machine deployment in commercial banks of Ethiopia.

The study aimed to assess the factors influencing the deployment of ATMs in Ethiopian commercial banks, using panel data from 13 banks between 2012 and 2016. The independent variable was ATM deployment, measured by the number of ATMs, while the dependent variables included bank size, profitability, deposit ratio, cost efficiency, and the number of branches. The results showed that bank size, profitability, and deposit ratio significantly influenced ATM deployment, whereas cost efficiency and the number of branches had no significant impact. The study recommended that Ethiopian banks prioritize bank size, profitability, and deposit ratios when expanding ATM deployment. A key lesson learned is that factors like bank size and profitability are critical drivers of ATM infrastructure deployment and should be central to technology adoption strategies.

Entele (2021). The study title: Impact of institutions and ICT services in avoiding resource curse: Lessons from the successful economies

The study investigates why some resource-abundant countries achieve economic success while others fall victim to the "resource curse," emphasizing the role of institutions and ICT services in addressing this issue. Using panel data from the World

Bank over a 25-year period (1995–2019) and focusing on nine countries, the study examined natural resource rent, institutional quality (legal, political, and economic institutions), ICT investment, trade openness, labor input, and non-ICT capital investment as independent variables, with real GDP per capita growth as the dependent variable. The findings confirm the existence of both resource and institutional curses in certain countries, but they also highlight that nations investing in human capital, adopting ICT services, and improving institutional quality can avoid these curses. The study recommends that resource-rich countries prioritize human capital development, institutional reforms, and ICT adoption to escape the resource curse and promote sustainable economic growth.

Al-Jabri, A. Y. (2022). The study title: The impact of technology adoption on the performance of banks:

The study analyzed the impact of FinTech adoption on the efficiency of commercial banks in selected MENA region countries, using a panel of 63 banks from Saudi Arabia, Egypt, Kuwait, Jordan, UAE, and Lebanon over the period 2011 to 2021. The independent variable was FinTech adoption, and the dependent variable was bank efficiency. The results showed that FinTech adoption significantly improved bank efficiency. The study recommended that banks in the MENA region continue adopting FinTech solutions to enhance operational efficiency. A key lesson learned is that FinTech adoption is crucial for improving the efficiency of commercial banks, underscoring the importance of technology in the financial sector.

Al-Amarneh et al. (2023). The study title: Nexus between information technology investment and bank performance: The case of Jordan.

The study investigated the relationship between IT investment and the performance—specifically profitability and efficiency—of commercial banks in Jordan. It analyzed data from 13 banks listed on the Amman Stock Exchange over the period 2010 to 2021. The independent variable was IT investment, measured as a percentage of total assets, while the dependent variables included profitability metrics (ROE, ROA, NIM) and operational efficiency. The results revealed that banks with higher IT investment, averaging 0.61% of total assets, demonstrated improved profitability and operational efficiency over time. The study recommended that banks increase IT investment to further enhance these performance metrics. A key lesson learned is that IT investments are essential for improving both profitability and operational efficiency in the banking sector over the long term.

Thakur et al. (2023). The study title: The impact of ICT on the profitability of Indian banks: The Moderating role of NPA.

The study examines the impact of Information and Communication Technology (ICT) on the profitability of Indian banks, focusing on how ICT influences banks during and after the COVID-19 pandemic. It analyzes data from 33 Indian banks over a 10-year period (2010–2019). The independent variable is ICT investment, with bank profitability measured by Net Interest Margin (NIM) as the dependent variable and Net Non-Performing Assets (NPA) as a moderating variable. The results show that ICT initially has a negative impact on profitability in a linear model, but in the quadratic model, it exhibits a positive U-curve relationship. Additionally, the presence of NPAs negatively affects the ICT-profitability relationship. The study recommends that banks continue investing in ICT to maximize long-term profitability, particularly by enhancing employee education and addressing the impact of NPAs. The key lesson learned is that while ICT

investments are crucial for long-term profitability, effective management of NPAs and investment in employee skills are necessary to fully capitalize on ICT benefits.

Nguyen, P. D. (2024). The study title: Non-performing loans and bank profitability: evidence from Vietnam.

    The study investigates the key factors determining Non-Performing Loans (NPLs) and their impact on bank profitability in Vietnam, using panel data from 2005 to 2020. The independent variable is NPLs, while bank profitability, measured by risk-adjusted returns, is the dependent variable. The results indicate that factors such as bank profitability, bank size, and economic booms help reduce NPLs, while operating costs, loan loss provisions, and macroeconomic factors exacerbate them. Some factors, like economic booms, economies of scale, and higher bank returns, contribute to improved loan quality, while higher policy rates, poor loan monitoring, and credit risks increase the number of NPLs. The study recommends that Vietnamese banks strengthen credit risk management, enhance loan recovery processes, adopt prudent lending practices to improve operational efficiency, and diversify income sources to mitigate NPLs and boost profitability. A key lesson learned is that NPLs significantly decrease bank profitability, underscoring the importance of effective credit risk management, prudent lending, and operational efficiency to maintain the financial stability and success of banks in Vietnam.

Zabin, S., Hossain, M. & Sultana, A. (2024). Impact of Non-Performing Loans on Bank Profitability: A Study of Rupali Bank PLC, Bangladesh, International Journal of Science and Business, 42(1), 159-174.

    The study investigates the negative effect of Non-Performing Loans (NPLs) on the profitability of Rupali Bank PLC in Bangladesh, using secondary data from the bank's annual reports covering the period from 2015 to 2022. The independent variable is NPLs, while the dependent variables are bank profitability indicators, specifically Return on

Assets (ROA) and Return on Equity (ROE). Linear regression was employed to test the research hypothesis and examine the impact of NPLs on these profitability indicators. The results reveal a significant negative correlation between NPLs and the bank's profitability, particularly with respect to ROA and ROE. The study recommends that credit risk management play a crucial role in maintaining profitability. A key lesson learned is the importance of implementing robust credit risk management practices to ensure ongoing profitability and financial stability at Rupali Bank PLC.

The above literature review explored the multifaceted relationship between technology adoption and bank profitability. Key findings indicate that technology investments, such as those in ICT infrastructure, Fintech, the Internet of Things, and block chain, can significantly enhance operational efficiency and employee productivity. Improved technology leads to better management of financial products and services, potentially increasing revenues and profit. However, this does not always result in higher profitability due to factors like varying tax frameworks and asset-related rebates Bank-specific factors such as size, branch network, asset management ratio, and operational efficiency also play a critical role in determining profitability. The review highlights that while technology can enhance Return on Assets (ROA) and Return on Equity (ROE), the extent of its impact depends on how well technology is integrated with overall bank operations and strategic goals.

Table (2.2) Literature Review summary of major studies

S. No.	Reference	Reference Country	Findings
1	Scott et al. (2017)	Across 29 Countries	Technology significantly impacts the profitability
2.	Teece, D. J. (2018)	Dutch	ICT improves revenue
3.	Adane et al. (2021)	Ethiopia	ATM improves profitability
4.	Wang et al. (2021)	China	Big Data improves profitability
5.	Adeabah et al. (2021)	Worldwide	ICT impacts pension income coverage.
6.	Wen et al. (2021)	World	(IoT) improving financial credit assessment.
7.	Del Gaudio et al. (2021)	European Union	ICT improves profitability
8.	Entele (2021)	World	ICT improves GDP per capita
9.	Thakur, et al. (2023)	India	ICT initially reduces profitability but follows a U-shaped trend in a quadratic model. NPAs weaken this positive ICT-profitability relationship.
10.	Al-Amarneh (2023)	Jordan	IT improves profitability
11.	AL-JABRI (2023)	MENA Countries	Technology Improves efficiency
12	Nguyen, P. D. (2024)	Vietnam	Economic growth, economies of scale, and bank returns enhance loan quality, while higher policy rates, poor loan monitoring, and increased credit risk can lead to more non-performing loans.
13	Zabin, S., Hossain, M. & Sultana, A. (2024).	Bangladesh	NPL affect negatively the profitability indicators ROE and ROA.

2.3 What are the differentiations between the current study and previous studies?

The above Studies have shown that effective deployment of technology, including Fintech and the Internet of Things (IoT) can improve profitability by optimizing transaction processes and enhancing risk management. For example, the use of the SWIFT Network and the deployment of ATMs have been found to influence profitability in various contexts positively. However, the benefits of technology investments are not immediate and often require sustained investment and careful management; it is evident that technology plays a crucial role in the banking sector. The review also underscores the

importance of employee training and development in technology implementation. Despite the focus on IT infrastructure, banks must invest in creating learning opportunities and a positive work environment to mitigate employee attrition and knowledge loss.

This study differs from others in that this study is designed to investigate the influence of technology investment on the profitability of commercial banks in Jordan, while also considering the mediating effect of non-performing loans (NPL). The central problem statement of this exhaustive study is to conduct a thorough analysis and comprehension of the extent to which technology investments affect the overall profitability of Jordanian commercial banks. This paper investigates how non-performing loans (NPL) could act as a mediator between this intricate relationship. Adopting new technology will help banks improve earnings; but, this depends on their technological setup, staff leadership, and bank profile. More study is required to grasp these connections in order to maximize technological investments for financial performance of the banking sector.

2.4 What research gap did this study cover?

This comprehensive study is designed to thoroughly investigate the intricate relationship between technology investment and the profitability of commercial banks in Jordan. It will specifically explore the potential influence of non-performing loans (NPL) as a mediating factor in this complex relationship. The study aims to delve deeply into how technology investments impact the overall profitability of Jordanian commercial banks and the role of non-performing loans (NPL) as a mediating factor in this dynamic interplay.

Chapter Three

Research Methodology (Method and Procedures)

Introduction

This chapter outlines the research population, sample selection, research design, and variable measurement. It also explains the data analysis techniques to achieve the research objectives and address the research question.

3.1 Study Methodology

The study will rely on the descriptive analytical approach by describing the variables of the study Represented by the Technology investment and Profitability elements (Net Interest margin, ROA, ROE) of Commercial banks in Jordan, where the study is considered a descriptive quantitative study because it studies the impact of the investment in Technology and Profitability elements. It also describes a current phenomenon on the ground, where statistical analysis will be used. Descriptive and testing its hypotheses to achieve its goals and know the changes and variances in the dependent variable "Profitability due to the changes caused by the independent variable with the presence of NPL as it provides information on the level of application of the main variables and expressing them statistically using tables, numbers, and benefit of which.

Profitability can be measured using ROA, ROE, and NIM. These are widely considered good indicators of bank profitability as they are based on publicly available data. The cost efficiency ratio determines the bank's investment cost efficiency. A low percentage indicates an increase in revenue or a decrease in costs. In the banks' financial reports from 2010 through 2020, the Technology investment variable is calculated as the total investment in technology software (computer systems and software apps for e-

banking and mobile banking, including communications, maintenance and technical cost.

etc.) and infrastructure (computer hardware, ATMs, etc.). More details about each

variable's measurement are explained in Table 3.1

Table (3.1) List of variables measurements

Variable Name	Variable Definition	Variable measurements
Independent Variable		
Investment in IT	Integrated Computer, hardware and software and Its expenditures like Telecommunication, maintenance and technical support. (Teece, 2018)	Tech-inv = the value of S/W , H/W and related investment / total PPE
Dependent Variables		
Net Interest Margin NIM	NIM is the percentage that represents the difference between a bank's interest earned and its interest paid out. (Goddard et al., 2004).	Net interest margin= net interest income/ total assets
Return on Assets ROA	Refers to a financial ratio that indicates how profitable a company is in relation to its total assets. (Berger & Humphrey, 1997).	Net income before taxes divided by total assets
Return On Equity ROE	A measure of a company's financial performance (Goddard et al., 2004).	Net income before taxes divided by total equity
Mediating Variable		
Non-Performing Loans NPLs	It is the credit facility provided by a bank for which interest or principal payments are overdue for 90 days or more., Makri et al., (2014).	Provision for Credit Facilities / Direct Credit Facilities, Net

In this study, we will assess variables using the panel data model (PDM) to get reliable

results. Baltagi (2008) says the PDM has cross-sectional and time-series properties. PDM

gives more information and is less biased on estimations than cross-section analysis or

time series. Also, endogeneity is less likely. In cases with significant endogeneity, PDM

has better solutions (Baltagi, 2008; Wooldridge, 2015). This study tests the hypothesis

using instrumental regression (IVreg) due to significant endogeneity. This is the main

rationale for employing PDM in this analysis.

3.2 Study Population

There are 20 licensed banks in Jordan, according to the Banking Sector Guide published by the Central Bank of Jordan and classified into three categories as follows:

Commercial Banks:

1. Arab Bank

2. Arab Banking Corporation (Jordan)

3. Bank of Jordan

4. Cairo Amman Bank

5. Capital Bank of Jordan

6. Jordan Commercial Bank

7. Jordan Kuwait Bank

8. Jordan National Bank

9. Housing Bank for Trade and Finance

10. Arab Jordan Investment Bank

11. Investment Bank

12. Société Générale Bank (Jordan)

13. Union Bank

Islamic Banks:

1. Arab International Islamic Bank

2. Jordan Islamic Bank

3. Safwa Islamic Bank

Branches of Foreign Banks:

1. Standard Chartered Bank

2. Egyptian Arab Land Bank

3. Citibank

4. Rafidain Bank

5. National Bank of Kuwait

6. Bank of Beirut and the Arab Countries (BBAC)

7. Bank Audi - Audi Saradar Group

8. National Bank of Abu Dhabi

3.3 Study Sample

The study covers 13 commercial banks listed in the Amman stock market as follows:

Table (3.2) List of Commercial Banks in Jordan

Date of Establishment	Commercial banks in Jordan	# Of branches inside Jordan
1930	Arab Bank	81
1956	Ahli Jordan Bank	51
1960	Bank Of Jordan	80
1960	Cairo Amman Bank	81
1974	Housing Bank for Trade and Finance	112
1977	Jordan Kuwait Bank	64
1978	Commercial Jordan Bank	32
1978	Arab Jordan Investment Bank	20
1989	ABC Bank	26
1989	Invest Bank	12
1991	Etihad Bank	52
1993	SGBJ	19
1996	Capital Bank	13

Source: Association of Banks in Jordan.

The current study focuses on 13 commercial banks operating in the Jordanian economy, specifically conventional commercial banks. Islamic banks following Shariah rules and not

directly lending money were excluded. The selection of the 13 conventional banks is due to their broad coverage of Jordan's banking system, which is a significant majority.

Balanced panel data synchronization was not available, but these 13 banks represent the majority of Jordan's banking system. The data was collected from the Amman Stock Exchange official website, systematically classifying the total number of banks into different categories. The study period covers 11 years from 2010 to 2020, The data from the major banks was collected from the Amman Stock Exchange database to ensure a sufficiently large sample size for reliable analysis.

3.4 Source of Data and Data Collection Methods

The study used the following sources for data collection:

Primary sources: The study gathered the necessary information for financial ratio calculations and other pertinent details from the following sources: the website of the Central Bank of Jordan, the Association of Banks in Jordan, and the Amman Stock Exchange financial statements of commercial banks.

Secondary sources: The study built its theoretical framework and identified the variables by referencing existing literature, including books, scientific publications, and research articles from journals, as well as information available on the internet relevant to the study's subject matter. The relationships between these variables were determined based on the insights and findings documented in these sources.

3.5 Study Type

Applied in nature, exploratory in purpose, and the commercial banks in Jordan will be analyzed at a single bank level.

3.6 Study Period

The collected data will cover the period from 2010 to 2020 data beyond 2020 was not included due to the impact of the COVID-19 pandemic.

3.7 Study design

Study design is the conceptual structure within which the study is conducted since it contains the mechanisms of data collection, variable measurements and analysis. The main objective is to investigate and determine how applying technology investment has an impact on the profit of commercial banks in Jordan. Also, determining the relationship between independent and dependent variables to reach the objectives of the study.

Data for this study was gathered from annual financial reports and notes to statements of the bank's financial position during the study period to determine how technology investment has impacted bank profitability.

3.8 Target population

The target population is the commercial banks operating in Jourdan. Listed in Table (3.2):

3.9 Sample size

For the present study, (13) banks were selected with details about number of branches of each bank, date of establishment, and because of the available financial data about their performance to be able to make inferences from the sample and to answer the study questions and test the hypotheses to reach the objective of the study (how technology investment has impacted the bank profitability).

3.10 Study Variables

Table (3.3): **List of Study Variable**

Variable Name	Variable Definition
Independent Variable	
Investment in IT	Integrated Computer, hardware and software and Its expenditures like Telecommunication, maintenance and technical support. (Teece, 2018)
Dependent Variables	
Net Interest Margin NIM	NIM is the percentage that represents the difference between a bank's interest earned and its interest paid out. (Goddard et al., 2004).
Return on Assets ROA	Refers to a financial ratio that indicates how profitable a company is in relation to its total assets. (Berger & Humphrey, 1997).
Return On Equity ROE	A measure of a company's financial performance (Goddard et al., 2004).
Mediating Variable	
Non-Performing Loans NPLs	It is the credit facility provided by a bank for which interest or principal payments are overdue for 90 days or more. Makri et al., (2014).

3.11 Research Model

The following figure 3.1 represents the research model:
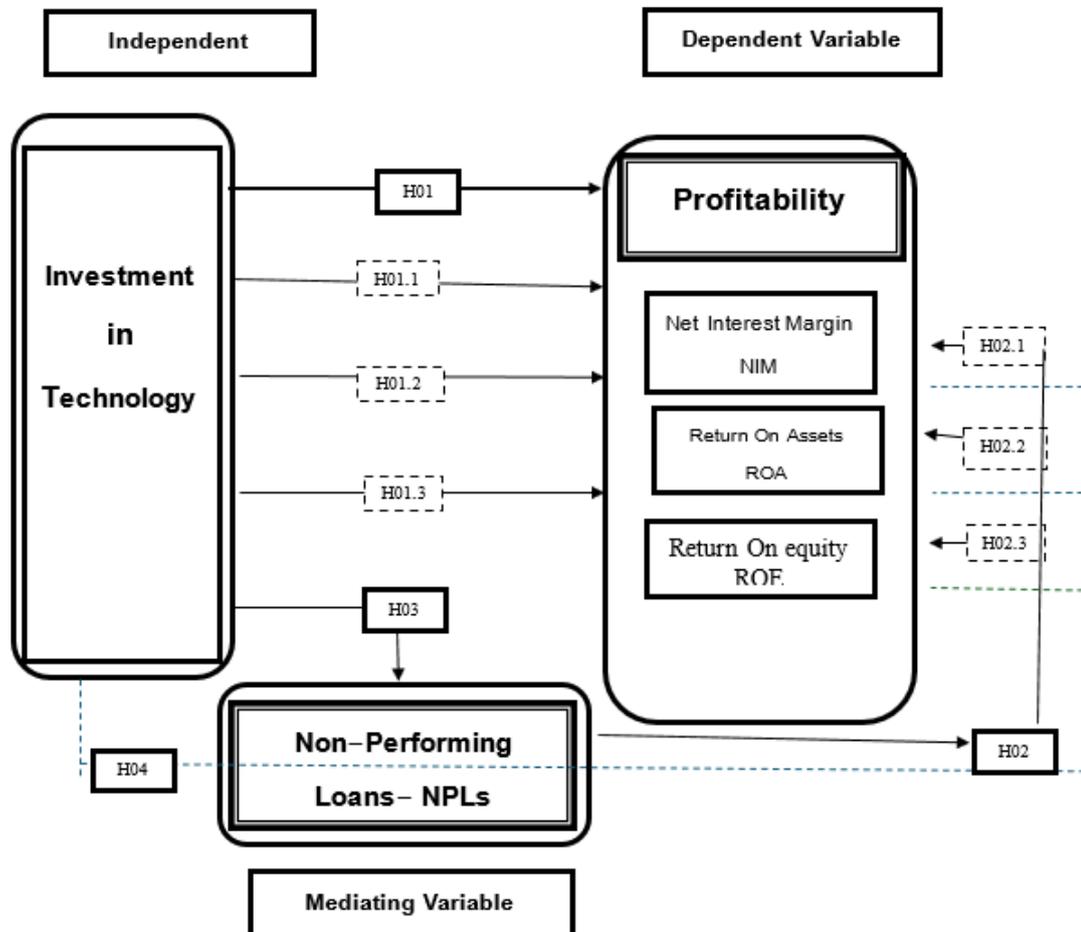
Figure 3. 1: Research Model

The following studies support the above model:

Al-Amarneh, et al. (2023), Zuo, L., Strauss, J., & Zuo, L. (2021), and Al-Jabri, A.

Y. (2022).

3.12 Statistical Methods

For the purpose of testing the study hypotheses, the Panel Data Analysis approach will be used:

- Descriptive statistics help glean information from samples, including median, upper and lower values, standard deviation, and Z-scores for each model

- Exploratory factor analysis is used to detect the validity of the data structure.

- Linear regression analysis and path analysis are used to test hypotheses.

3.13 Research Models

H01: Profitability = β0 + β1(Technology Investment) + ε

H01-1: (NIM) = β0 + β1(Technology Investment) + ε

H01-2: (ROA) = β0 + β1(Technology Investment) + ε

H01-3:(ROE) = β0 + β1(Technology Investment) + ε

H02: Profitability = β0 + β1(Non-Performing Loans) + ε

H02-1: (NIM) = β0 + β1(Non-Performing Loans) + ε

H02-2: (ROA) = β0 + β1(Non-Performing Loans) + ε

H02-3: (ROE) = β0 + β1(Non-Performing Loans) + ε

H03: Non-Performing Loans = β0 + β1(Technology Investment) + ε

H04: Profitability = β0 + β1(Technology Investment) + β2(Non-Performing Loans) + β3(Technology Investment * Non-Performing Loans) + ε

H04-1: (NIM) = β0 + β1(Technology Investment) + β2(Non-Performing Loans) + β3(Technology Investment * Non-Performing Loans) + ε

H04-2: (ROA) = β0 + β1(Technology Investment) + β2(Non-Performing Loans) + β3(Technology Investment * Non-Performing Loans) + ε

H04-3: (ROE) = β0 + β1(Technology Investment) + β2(Non-Performing Loans) +

β3(Technology Investment * Non-Performing Loans) + ε

Notes:

- β0: is the intercept.

- β1 and β2 and β3: represent the regression coefficients for the independent

  variables.

- ε: is the random error.

Statistical Methods Used in the Study

To test the study hypotheses, the following statistical methods were utilized, which include the Eviews and AMOS software:

- Descriptive Statistical Measures: Such as maximum value, minimum value, mean,

  and standard deviation.

- Correlation Coefficient: To measure the correlation between the study variables.

- Regression Analysis: To examine the impact of the independent variable on the

  dependent variable and to verify the impact of the mediating variable on the

  dependent variable.

- Path Analysis: Using AMOS to construct the proposed model for the study, which

  is used to determine the impact of the independent variable on the dependent

  variable in the presence of the mediating variable.

Chapter Four

Analysis of Data

4.1 Introduction

The current chapter presents the results of statistical analysis, as this chapter was divided into two parts, the first section includes a description of the study community data through conducting descriptive analysis with the help of descriptive statistical standards represented by (higher and minimum values, standard deviation, and mathematical average), while The second section included the study of the study hypotheses based on the test of simple regression analysis, and Path Analysis.

4.2 Descriptive Statistics

This study investigates the impact of Investment in Technology on the Profitability and the mediating role of Non-Performing Loans in Jordanian Commercial Banks. To achieve the objectives of the study, the descriptive data of the independent study variable, the dependent variables and the mediating variable were analyzed by extracting the actual data in the annual reports published by Jordanian Commercial Banks, numbering (13) banks. Table (4.1) shows the results of the descriptive analysis of the study variables:

Table (4.1) Results of the descriptive analysis of the study variable

Variables	Minimum	Maximum	Mean	Std. Deviation	No. of Observations
investment in technology	0.074700	0.952300	0.568771	0.201336	143
NIM	0.01116	0.05835	0.0309610	0.00780116	143
ROA	-0.00199	0.04999	0.0162694	0.00779939	143
ROE	-0.01222	0.31502	0.1168679	0.05028346	143
Average Profitability	0.00511	0.14112	0.0546994	0.02095778	143
Non-Performing Loans	0.01625	0.22400	0.0823903	0.03820137	143

According to Table (4-1), which displays the results of the descriptive analysis of the study variables, we find that the value of the mathematical medium investment in technology amounted to (0.568771= 56.88%), This indicates that, on average, the proportion of investment in technology relative to total investment in property, plant, and equipment (PPE) is relatively high in the studied banks. . The table also shows an increase in the value of the standard deviation, which amounted to (0.0.201336 = 20%), which indicates a significant difference between the higher and minimum values. the lowest value of technology investment (0.074700 = 7.5%), indicating that some banks invest very small amounts in technology development. On the other hand, the highest value (0.952300= 95%) was, which indicates that there are other banks that invest greater amounts in this field, and that this great contrast between values indicates that there are clear differences in technological investment strategies between banks, Banks with lower investments may be at risk of falling behind in operational efficiency and market competitiveness, as technology plays a critical role in streamlining processes, improving customer experiences, and enabling innovation, On the other hand, banks with higher investments are likely better positioned to leverage advanced technologies, such as artificial intelligence, data analytics, and automation, to enhance their services and gain a competitive edge. Consequently, these results reflect the necessity of enhancing investment in technology in general, to ensure improvement of operational efficiency and enhance the competitiveness of banks in the market.

The analysis of the Average Profitability variable provides valuable insights into the financial performance of the studied banks. The data shows a range of profitability levels, with a minimum value of (0.00511 = 0.5%), a maximum value of (0.14112= 14%), and an average profitability of (0.0546994 = 5.5%). The standard deviation of (0.02095778

= 2.1%) indicates variability in profitability across banks, reflecting differences in their ability to generate profits from their assets. Banks with a profitability ratio of 14% demonstrate exceptional efficiency in utilizing their assets to generate profits. These banks likely have strong revenue streams, effective cost management, and optimal asset allocation, high profitability reflects robust financial health and competitiveness, enabling these banks to reinvest in growth opportunities and maintain a strong market position. Banks with a low profitability ratio of 0.5% face significant challenges in achieving satisfactory financial results. This low profitability may stem from inefficient resource management, high operational costs, or underperforming assets, such banks are at risk of losing competitiveness and may struggle to sustain long-term growth unless they address the underlying issues affecting their profitability. The average profitability of 5.5% suggests that while many banks are performing adequately, there is considerable room for improvement. Banks in this range should focus on enhancing their profitability to align with or exceed industry benchmarks, achieving higher profitability can strengthen their financial position and enable them to better compete in the market. The Standard Deviation (2.1%) highlights differences in financial performance among banks. This variation may be attributed to factors such as management efficiency, asset quality, cost structures, and market positioning, understanding the drivers of these differences is crucial for developing targeted strategies to improve profitability.

The variability in profitability across banks underscores the importance of improving profitability management strategies. By addressing inefficiencies, diversifying revenue streams, and optimizing asset utilization, banks can enhance their financial performance and competitiveness. For banks with low profitability, implementing targeted measures is critical to achieving sustainable growth and ensuring long-term success in the market.

The results presented in Table 4-1 concerning the **Net Interest Margin (NIM)** reveal an arithmetic mean of (0.0309610 = 3.1%) with a standard deviation of (0.00780116 =0.78%). The NIM is a critical financial metric that represents the ratio of net interest income to total interest earning assets, serving as an indicator of a bank's ability to convert its asset base into profitable returns. A higher NIM suggests that a bank is effectively leveraging its interest earning assets to generate income, thereby demonstrating operational efficiency and sound financial management.However, the data also indicates a minimum NIM of (0.01116 = 1.1%), highlighting that certain financial institutions may face challenges in efficiently managing their interest earning assets to yield sufficient interest income. This lower margin could be attributed to factors such as suboptimal lending practices, high levels of non-performing assets, or competitive pressures limiting interest income. Consequently, banks with a lower NIM may need to reassess and enhance their asset management strategies, possibly by diversifying their loan portfolios, improving credit assessment processes, or optimizing interest rate structures to improve profitability. these findings underscore the significance of enhancing banking efficiency in generating returns from investments. Efficient asset management is not only essential for profitability but also for sustaining competitive advantage in the dynamic and often volatile banking market. Banks that can maintain a high NIM are better positioned to economic downturns, respond to regulatory changes, and capitalize on growth opportunities. Therefore, continuous evaluation and improvement of asset management practices are imperative for financial institutions aiming to strengthen their market position and ensure long-term stability.

The analysis of Return on Equity (ROE) provides valuable insights into how effectively Jordanian commercial banks are utilizing shareholders' funds to generate profits. The high ROE reflects superior financial performance and the ability to deliver significant value to shareholders, which can attract more investors and enhance the bank's market reputation. the arithmetic mean ROE of (0.1168679 = 11.7%) indicates that, on average, these banks are generating a reasonable return for their shareholders. However, the range of ROE values from a low of (-0.01222 = -1.2%) to a high of (0.31502 = 31.5%) along with a standard deviation of (0.05028346 = 5%), reveals variability in the efficiency of bank management in deploying shareholders' capital. Banks with an ROE of 31.5% demonstrate exceptional efficiency in utilizing shareholders' funds to generate profits these banks likely have strong revenue streams, effective cost management, and optimal capital allocation strategies. Whereas Banks with a negative or very low ROE (-1.2%) indicate poor management efficiency in investing shareholders' funds. This could result from underperforming assets, high operational costs, or ineffective strategic decisions, such banks may face challenges in retaining investor confidence and may need to undertake significant reforms to improve profitability and shareholder value, The average ROE of 11.7% suggests that most banks are performing reasonably well in generating returns for shareholders. However, there is still room for improvement to align with or exceed the performance of top-performing banks. Banks in this range should focus on optimizing their capital structure, improving operational efficiency, and exploring growth opportunities to enhance ROE, the relatively low standard deviation indicates that there is no significant difference in ROE among most banks. However, the presence of outliers (e.g., -1.2% and 31.5%) highlights the need for targeted interventions to address underperformance and replicate the success of high-performing banks.

As for the return on assets **(ROA),** its computational medium reached (0.0162694 = 1.63%) with a standard deviation of (0.00779939 = 0.78%), and this indicates that, on average, banks are moderately effective in converting their assets into profits, as the height of this percentage indicates the bank's ability to achieve profitability . However, Banks with a negative or very low ROA (-0.2%) indicate poor management efficiency. This could result from ineffective asset allocation, underperforming investments, high operational costs, or non-performing loans. Such banks may struggle to remain competitive and could face long-term sustainability challenges if they fail to improve their profitability. while Banks with an ROA of 5% demonstrate strong management efficiency and effective asset utilization. These banks are likely employing optimal strategies to maximize returns, such as investing in high-yield projects, maintaining a balanced portfolio, and controlling costs effectively, this high level of profitability reflects their ability to generate substantial income relative to their asset base, which is a key indicator of financial health and competitiveness, the results highlight the variability in ROA across banks highlights the importance of improving profit management strategies, enhancing asset utilization, controlling costs, and adopting innovative approaches can help banks increase their profitability, strengthen their financial performance, and remain competitive in the market.

As for of Non-Performing Loans **(NPLs)** as a mediating variable The analysis reveals critical insights into the credit risk management practices and financial health of banks. The data shows a wide range of NPL ratios, from a minimum of (0.01625 = 1.6%) to a maximum of (0.22400 =22.4%), with an average of (0.0823903 =8.23%) and a standard deviation of (0.03820137 =3.82%). These results highlight significant variability in the quality of banks' credit portfolios and their exposure to credit risk which can adversely

affect profitability, this variability underscores the need for enhanced credit risk management practices and the implementation of robust lending strategies to improve the overall financial health and sustainability of the banks.

4.3 Study hypotheses test

Testing study hypotheses is an essential part of research work, as it aims to achieve the main goal of study and verifying the validity of the proposed assumptions. Here are the results of the study

4.3.1 The result of the first main hypothesis test

H01: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks.

To analyze this hypothesis, a linear regresion analysis was used as shown in Table (4.2).

Table (4.2) Results of the regression analysis of the investment in technology on the profitability

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Profitability	Investment in Technology	-0.003419	0.004993	- 0.684726	0.4948
	C	0.014338	0.003859	3.715574	0.0003
	Profitability (-1)	0.726206	0.051522	14.09506	0.0000
(R Square)		0.550766			
(Adjusted R Square)		0.543692			
F-statistic		77.85175*			
F (sig)		0.000000			
Durbin-Watson stat		1.722501			
* Statistically significant at the level (0.05)					

* Profitability was measured by the arithmetic mean value of profitability dimensions (ROA,ROE,NIM)

Table (4.2) indicates that the value of the value of R Square **(0.550766)** indicates that investment in Technology explained **(55%)** of the variance in Profitability. It is noted that there is a statistically significant impact of investment in Technology on the Profitability

of Jordanian Commercial Banks, through the value of F-statistic =(77.8517) and F.-Sig equal to (0.000) and the Durbin-Watson statistics (1.722501) which indicate that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for investment in Technology reached - 0.003419), which indicates that a high level of investment in technology will negatively affect the profitability of the bank. Since there was no conclusive evidence that banks substantial spending on technology improved profitability, this gives a rise to the term "Technology Profitability Paradox."

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: **There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks**.

After testing the first main hypothesis, the sub -hypotheses emanating from it were tested, and the results came as follows:

- **The result of the first sub -hypothesis test**

  H01-1: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

To analyze this hypothesis, a regression analysis was used as shown in Table (4.3).

Table (4.3) Results of the regression analysis of the Investment in Technology on Net Interest Margin (NIM)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Net Interest Margin	Investment in Technology	0.001575	0.001676	0.939584	0.3494
	C	0.007512	0.001754	4.283853	0.0000
	Net Interest Margin (-1)	0.715157	0.051388	13.91671	0.0000
(R Square)		0.903012			
(Adjusted R Square)		0.891204			
F-statistic		76.47930			
F (sig)		0.000000			
Durbin-Watson stat		2.124686			
* Statistically significant at the level (0.05)					

Table (4.3) indicates that the value of **R Square (0.903012)** shows that investment in Technology explained **90%** of the variance in Net Interest Margin (NIM). It is noted that there is a statistically significant impact of investment in Technology on the Net Interest Margin of Jordanian Commercial Banks, with the F-statistic = 76.47930 and (F.-Sig) value equal to (0.000) and the Durbin-Watson statistic (2.124686), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for investment in Technology reached (0.001575), which indicates that a high level of investment in technology will positively affect the Net Interest Margin of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

- **Second sub-hypothesis test result**

  H01-2: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return On Assets (ROA)**.**

To analyze this hypothesis, a linear regresion analysis was used as shown in Table (4.4).

Table (4.4): Results of the Regression Analysis of the Investment in Technology on Return on Assets (ROA)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Return on Assets	Investment in Technology	-0.001084	0.001913	-0.566978	0.5717
	C	0.003578	0.001326	2.698901	0.0079
	Return on Assets (-1)	0.756379	0.053120	14.23910	0.0000
(R Square)		0.577359			
(Adjusted R Square)		0.570703			
F-statistic		86.74573			
F (sig)		0.000000			
Durbin-Watson stat		1.723872			
* Statistically significant at the level (0.05)					

Table (4.4) indicates that the value of **R Square (0.577359**) shows that investment in Technology explained **57.7%** of the variance in Return on Assets (ROA). It is noted that there is a statistically significant impact of investment in Technology on the Return on Assets of Jordanian Commercial Banks, with the F-statistic = 86.74573 and (F.-Sig) value equal to (0.000), The Durbin-Watson statistic (1.723872), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for investment in Technology reached (- 0.001084), which indicates that a high level of investment in technology will negatively affect the Return on Assets of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return On Assets (ROA).

- **Result of the third sub-hypothesis test**

  H01-3: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return On Equity (ROE)**.** A regression analysis was used to analyze this hypothesis, as shown in Table (4.5).

Table (4.5) Results of Regression Analysis of the Investment in Technology on Return on Equity (ROE)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Return on Equity	Investment in Technology	-0.008119	0.015125	-0.536759	0.5924
	C	0.035385	0.011273	3.138988	0.0021
	Return on Equity (-1)	0.684157	0.063604	10.75655	0.0000
(R Square)		0.478879			
(Adjusted R Square)		0.470672			
F-statistic		58.35259			
F (sig)		0.000000			
Durbin-Watson stat		1.689369			
* Statistically significant at the level (0.05)					

Table (4.5) indicates that the value of **R Square (0.478879)** shows that investment in Technology explained **47.9%** of the variance in Return on Equity (ROE). It is noted that there is a statistically significant impact of investment in Technology on the Return on Equity of Jordanian Commercial Banks, with the F-statistic = 58.35259 and (F.-Sig) value equal to (0.000). The Durbin-Watson statistic (1.689369), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for investment in Technology reached (-0.008119), which indicates that a high level of investment in technology will negatively affect the Return on Equity of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return on Equity (ROE).

4.3.2 Result of testing the second main hypothesis

H02: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks.

To analyze this hypothesis, a regression analysis was used as shown in Table (4.6).

Table (4.6): Results of the Regression analysis of Non-Performing Loans on Profitability

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Profitability	Non-Performing Loans	-0.082088	0.033642	-2.440032	0.0161
	C	0.021518	0.005001	4.302866	0.0000
	Profitability (-1)	0.680689	0.059081	11.52121	0.0000
(R Square)		0.569727			
(Adjusted R Square)		0.562951			
F-statistic		84.08061			
F (sig)		0.000000			
Durbin-Watson stat		1.681614			
* Statistically significant at the level (0.05)					

* Profitability was measured by the arithmetic mean value of profitability dimensions (ROA,ROE,NIM).

Table (4.6) indicates that the value of **R Square (0.569727)** shows that Non-Performing Loans explained **56.9%** of the variance in Profitability. It is noted that there is a statistically significant impact of Non-Performing Loans on the Profitability of

Jordanian Commercial Banks, with the F-statistic equal to 84.08061 and (F.-Sig) value equal to (0.000) and the Durbin-Watson statistic (1.681614), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for Non-Performing Loans reached (= -0.082088), which indicates that an increase in Non-Performing Loans negatively affects the Profitability of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks.

After testing the second main hypothesis, the sub-hypotheses originating from it were tested, and the results came as follows:

- **Result of testing the first sub-hypothesis**

    H02-1: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

To analyze this hypothesis, a regression analysis was used as shown in Table (4.7).

Table (4.7) Results of the regression analysis of Non-Performing Loans on Net Interest Margin (NIM)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Net Interest Margin	Non-Performing Loans	-0.006867	0.006629	-1.035865	0.3022
	C	0.003644	0.001039	3.506016	0.0006
	Net Interest Margin (-1)	0.885927	0.032327	27.40548	0.0000
(R Square)		0.850936			
(Adjusted R Square)		0.848589			
F-statistic		362.4919			
F (sig)		0.000000			
Durbin-Watson stat		2.073409			
* Statistically significant at the level (0.05)					

Table (4.7): indicates that the value of **R Square** (**0.850936**) shows that Non-Performing Loans explained **85 %** of the variance in Profitability. It is noted that there is a statistically significant impact of Non-Performing Loans on the Profitability of Jordanian Commercial Banks, with the F-statistic = 362.4919 and (F.-Sig) value equal to (0.000), The Durbin-Watson statistic (2.073409), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for Non-Performing Loans reached (- 0.006867), which indicates that an increase in Non-Performing Loans negatively affects the Profitability of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).

- **Second sub-hypothesis test result**

    H02-2: There is no statistically significant impact at the significance level ($\alpha \le 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).

To analyze this hypothesis, a linear regresion analysis was used as shown in Table (4.8).

Table (4.8) Results of the regression analysis of Non-Performing Loans on Return on Assets (ROA)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Return on Assets	Non-Performing Loans	-0.016505	0.011211	-1.472284	0.1434
	C	0.004616	0.001456	3.170116	0.0019
	Return on Assets (-1)	0.736277	0.060708	12.12816	0.0000
(R Square)		0.582471			
(Adjusted R Square)		0.575896			
F-statistic		88.58539			
F (sig)		0.000000			
Durbin-Watson stat		1.693764			
* Statistically significant at the level (0.05)					

Table (4.8) indicates that the value of **R Square (0.582471)** shows that Non-Performing Loans **explained 58.2%** of the variance in Return on Assets (ROA). It is noted that there is a statistically significant impact of Non-Performing Loans on the Return on Assets of Jordanian Commercial Banks, with the F-statistic = 88.58539 and (F.-Sig) value equal to (0.000) with the Durbin-Watson statistic (1.693764), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for Non-Performing Loans reached (- 0.016505), which indicates that an increase in Non-Performing Loans negatively affects the Return on Assets of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).

- **Result of the third sub-hypothesis test**

    H02-3: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Equity (ROE). To analyze this hypothesis, a regression analysis was used as shown in Table (4.9).

Table (4.9): Results of the regression analysis of Non-Performing Loans on Return on Equity (ROE)

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Return on Equity	Non-Performing Loans	-0.247680	0.087537	-2.829446	0.0054
	C	0.058392	0.012511	4.667378	0.0000
	Return on Equity (-1)	0.619741	0.064657	9.585113	0.0000
(R Square)		0.508669			
(Adjusted R Square)		0.500931			
F-statistic		65.74068			
F (sig)		0.000000			
Durbin-Watson stat		1.643478			
* Statistically significant at the level (0.05)					

Table (4.9) indicates that the value of **R Square (0.508669)** shows that Non-Performing Loans explained **50.9%** of the variance in Return on Equity (ROE). It is noted that there is a statistically significant impact of Non-Performing Loans on the Return on Equity of Jordanian Commercial Banks, with the F-statistic = 65.74068 and (F.-Sig) value equal to (0.000) and the Durbin-Watson statistic (1.643478), indicating that there is no autocorrelation (serial correlation).

The coefficients table shows that the value of the coefficient for Non-Performing Loans reached (-0.247680), which indicates that an increase in Non-Performing Loans significantly negatively affects the Return on Equity of the bank.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return On Equity (ROE).

4.3.3 Result of testing the third main hypothesis

H03: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in technology on the Non-Performing Loans.

To analyze this hypothesis, a regression analysis was used as shown in Table (4.10).

Table (4.10): Results of the regression analysis of the Investment in Technology on Non-Performing Loans

dependent variable	Independent variable	Coefficients[a]			
		Coefficient	Std. Error	T Statistics	T Sig
Non-Performing Loans	Investment in Technology	0.005334	0.010365	0.514649	0.6078
	C	0.018739	0.010167	1.843115	0.0679
	Non-Performing Loans (-1)	0.698650	0.104248	6.701818	0.0000
(R Square)		0.738260			
(Adjusted R Square)		0.706396			
F-statistic		23.16912			
F (sig)		0.000000			
Durbin-Watson stat		1.813985			
* Statistically significant at the level (0.05)					

Table (4.10) shows that the value of **R Square (0.738260)** indicates that Investment in Technology explained **73.8%** of the variance in Non-Performing Loans. It is noted that there is a statistically significant impact of Investment in Technology on Non-Performing Loans of Jordanian Commercial Banks, with the F-statistic equal to   23.16912 and

(F.-Sig) value equal to (0.000) and the Durbin-Watson statistic (1.813985), suggesting that there is no autocorrelation (serial correlation).

The coefficients table reveals that the coefficient for Investment in Technology is (0.005334), indicating a positive relationship between Investment in Technology and Non-Performing Loans.

Based on the previous results, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in technology impact on the Non-Performing Loans.

4.3.4 The fourth main hypothesis

H04: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks Considering the Mediating Impact of Non-Performing Loans.

To test the validity of the fourth hypothesis related to the direct and indirect impact, path analysis was used, with the help of the Amos program, to verify the existence of the direct and indirect impact of the study variables, and the results were as follows:

Table (4.11) Values of the fit indices for the path model

Model fit indices							
Chi^2	df	GFI	CFI	IFI	NFI	RMSEA	Probability level
0.00	4	.0989	1.000	1.000	1.000	0.033	0.00
Goodness of Fit Index proximity						GFI	
Comparative Fit Index						CFI	
Incremental Fit Index						IFI	
Normed Fit Index						NFI	
Root mean square error of approximation						RMSEA	

The results of the statistical analysis in Table (4.11) showed that the value of (0.00= Chi2) where Degrees of freedom (df) was equal to (0), and on the other hand, the index (Goodness of Fit index proximity) reached (0.989= GFI), as well as Comparative Fit Index (1.000= CFI), and Incremental Fit Index (1.000= IFI), and Normed Fit Index (1.000= NFI), and all the values of these indicators were close to the number (1) or equal to (1), which indicates the goodness of fit of the study model, while the Root mean square error of approximation index reached (0.033= RMSEA), which is close to zero, which supports the goodness of fit of the model (Byrne, 2010).

Table (4.12) Coefficients of direct and indirect impacts and the total impact of the fourth main hypothesis

Variables	Direct impact		Indirect impact		Total impact	
	Investment in Technology	NPLs	Investment in Technology	NPLs	Investment in Technology	NPLs
NPLs	3.178	-	-	-	3.178	-
Profitability	.634	-.208	-.662	-	-.028	-.208

* Profitability was measured by the arithmetic mean value of profitability dimensions (ROA,ROE,NIM).

Table (4.12) shows that the direct impact of (Investment in Technology) on (Profitability) reached (0.634) which is not statistically significant, while the direct impact of (Investment in Technology) on (NPLs) reached (3.178) which is statistically significant. On the other hand, the direct impact of (NPLs) on (Profitability) reached (-0.208) which is statistically significant.

Table (4.12) also showed that the indirect impact of (Investment in Technology) on (Profitability) with the presence of the mediating variable (NPLs) reached (-0.662), which is a statistically significant impact, as the total impact of (Investment in Technology) with the presence of the mediating variable (NPLs) on (Profitability) reached (-0.208),

meaning that (NPLs) have an intermediary role in the relationship between (Investment in Technology) and (Profitability).

Accordingly, the fourth main null hypothesis was rejected and the alternative hypothesis was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks Considering the Mediating Impact of Non-Performing Loans.

After testing the fourth main hypothesis, the sub-hypotheses emanating from it were
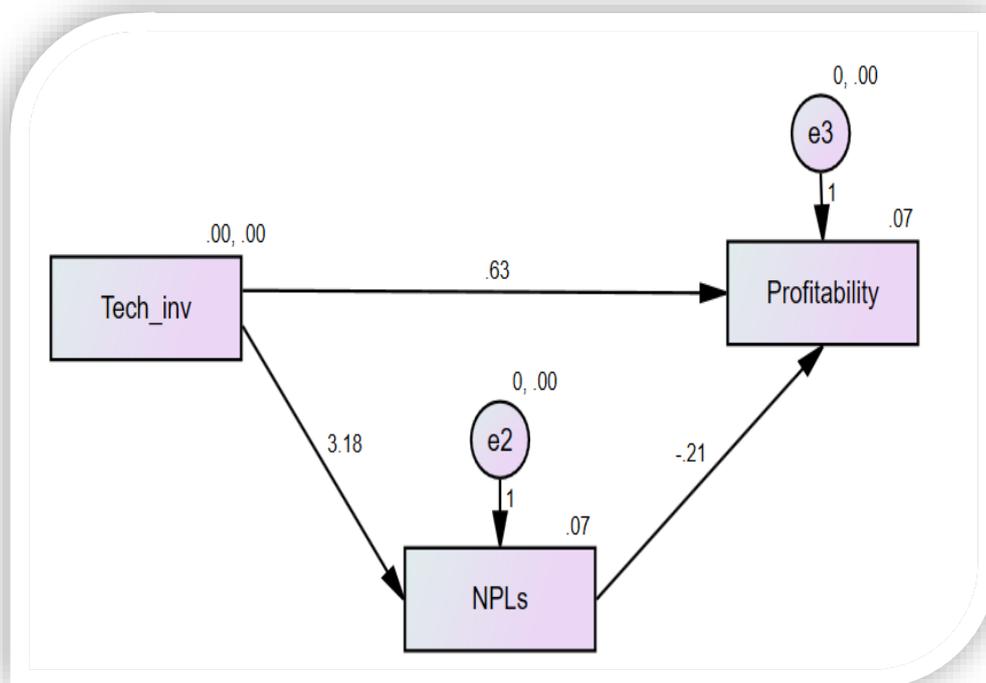
Figure (4.1): Results of path analysis test to verify the direct and indirect impact of investment in Technology on (profitability) with the presence of the mediating variable (Non-Performing Loans)

H04-1: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM) Considering the Mediating Impact of Non-Performing Loans.

H04-2: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return On Assets (ROA) Considering the Mediating Impact of Non-Performing Loans.

H04-3: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return On Equity (ROE) Considering the Mediating Impact of Non-Performing Loans.

To test the validity of the sub-hypothesis related to the direct and indirect impact, path analysis was used, using the Amos program, to verify the existence of the direct and indirect impact of the study variables. The results were as follows:

Table (4.13) Values of the fit indices for the path model

Model fit indices							
Chi^2	df	GFI	CFI	IFI	NFI	RMSEA	Probability level
0.00	3	979.0	996.0	0.996	0.978	0.038	0.015
Goodness of Fit Index proximity							GFI
Comparative Fit Index							CFI
Incremental Fit Index							IFI
Normed Fit Index							NFI
Root mean square error of approximation							RMSEA

The results of the statistical analysis in Table (4.13) showed that the value of (372.046= Chi2) where Degrees of freedom (df) was equal to (4), and on the other hand, the index (Goodness of Fit Index proximity) reached (0.979= GFI) which is close to the number (1), as the closer it is to (1), the more it indicates good quality fit, as well as the Comparative Fit Index (0.966= CFI), and the Incremental Fit Index (0.996= IFI), and the Normed Fit Index (0.978= NFI), and all the values of these indicators were close to the number (1), which indicates good quality fit for the study model, while the Root mean

square error of approximation index reached (0.038= RMSEA) which is close to zero, which supports the goodness of the model's agreement (Byrne, 2010).

Table (4.14): Coefficients of direct and indirect impacts and the total impact of the sub-hypotheses

Total impact		Indirect impact		Direct impact		
NPLs	Investment in Technology	NPLs	Investment in Technology	NPLs	Investment in Technology	Variables
-	3.178	-	-	-	3.178	**NPLs**
-0.284	-.028	-	-1.732	-0.545	1.449	**NIM**
-0.019	-.028	-	-0.180	-0.057	0.161	**ROA**
0.217	-.028	-	-0.074	-0.023	0.292	**ROE**

- **The result of testing the first sub-hypothesis**

Table (4.14) shows that the direct impact of (Investment in Technology) on (NIM) reached (0.634) which is not statistically significant, while the direct impact of (Investment in Technology) on (NPLs) reached (3.178) which is statistically significant. On the other hand, the direct impact of (NPLs) on (NIM) reached (-0.545) which is not statistically significant.

Table (4.14) also showed that the indirect impact of (Investment in Technology) on (NIM) with the presence of the mediating variable (NPLs) reached (-1.732), which is a statistically significant impact, as the total impact of (Investment in Technology) with the presence of the mediating variable (NPLs) on (NIM) reached (-0.284), meaning that (NPLs) have a mediating role in the relationship between (Investment in Technology) and (NIM).

Accordingly, the first null sub-hypothesis was rejected and the alternative hypothesis was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial

Banks measured by Net Interest Margin (NIM) Considering the Mediating Impact of Non-Performing Loans.

- **The result of testing the second sub-hypothesis**

Table (4.14) shows that the direct impact of (Investment in Technology) on (ROA) reached (0.161) which is not statistically significant, while the direct impact of (Investment in Technology) on (NPLs) reached (3.178) which is statistically significant. On the other hand, the direct impact of (NPLs) on (ROA) reached (-0.057) which is statistically significant.

Table (4.14) also showed that the indirect impact of (Investment in Technology) on (ROA) with the presence of the mediating variable (NPLs) reached (-0.180), which is a statistically significant impact, as the total impact of (Investment in Technology) with the presence of the mediating variable (NPLs) on (ROA) reached (-0.019), meaning that (NPLs) have a mediating role in the relationship between (Investment in Technology) and (ROA).

Accordingly, the second null sub-hypothesis was rejected and the alternative hypothesis was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return On Assets (ROA) Considering the Mediating Impact of Non-Performing Loans.

- **The result of testing the third sub-hypothesis**

Table (4.14) shows that the direct impact of (Investment in Technology) on (ROE) reached (0.292) which is not statistically significant, while the direct impact of (Investment in Technology) on (NPLs) reached (3.178) which is statistically significant.

On the other hand, the direct impact of (NPLs) on (ROE) reached (-0.023) which is statistically significant.

Table (4.14) also showed that the indirect impact of (Investment in Technology) on (ROE) with the presence of the mediating variable (NPLs) reached (-0.074), which is a statistically significant impact, as the total impact of (Investment in Technology) with the presence of the mediating variable (NPLs) on (ROE) reached (-0.217), meaning that (NPLs) have a mediating role in the relationship between (Investment in Technology) and (ROE).

Accordingly, the third null sub-hypothesis was rejected and the alternative hypothesis was accepted, which states: There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by return On Equity (ROE) Considering the Mediating Impact of Non-Performing Loans.
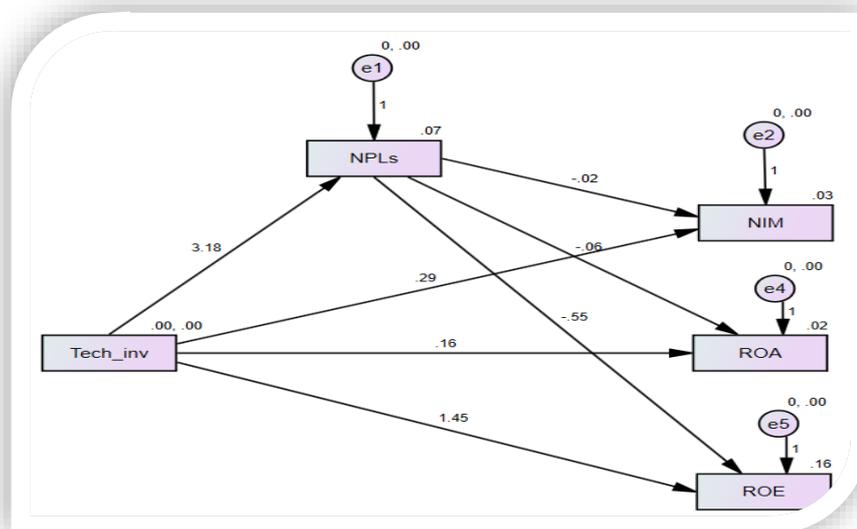
Figure (4.2): Results of the path analysis test to verify the direct and indirect impact of investment in Technology on dimensions (profitability) with the presence of the mediating variable (Non-Performing Loans)

CHAPTER FIVE:

Conclusions and Implications

5.1 Introduction

This chapter reviews the study results and discusses the results in light of the results of the statistical analysis of the study variables and testing the study hypotheses.

5.2 Results of descriptive tests for the study variables

- **Investment in Technology**: The analysis highlights a significant disparity in technology investment strategies among banks, with some allocating minimal resources (as low as 7.5%) while others invest substantially (up to 95%). this big contrast underscores the varying levels of priority that banks place on technological development, to address this gap banks with lower investment levels should consider reevaluating their strategies and allocating more resources to technology development, this could involve adopting a phased approach, starting with foundational technologies and gradually scaling up to more advanced solutions. Collaboration with fintech companies or investing in partnerships could also be a viable strategy to accelerate technological adoption. The findings emphasize the importance of increasing technology investment across the banking sector. By doing so banks can improve their operational efficiency, reduce costs, and offer more innovative and customer-centric solutions. This is crucial in an increasingly digital and competitive market, where technological capabilities are a key differentiator.

- **Profitability**: The results indicating reasonable efficiency in producing profits from total assets, the average profitability level was (0.0546994=5.47%). The

least recorded profitability was 0.00511= 0.51%; the maximum was 0.14112 =14.11%. A low minimum suggests that some banks have poor resources management, for banks with low profitability, implementing targeted measures is critical to achieving sustainable growth and ensuring long-term, the variability in profitability across banks underscores the importance of improving profitability management strategies. By addressing inefficiencies, diversifying revenue streams, and optimizing asset utilization, banks can enhance their financial performance and competitiveness. success in the market.

- **Net Interest Margin (NIM):** The analysis revealed that an average Net Interest Margin (NIM) of 3.1% with a standard deviation of 0.78%, indicating variability in banks' ability to generate returns from interest-earning assets. A higher NIM reflects efficient asset management and strong financial performance, while the lowest recorded NIM of 1.1% suggests that some banks struggle with profitability due to factors like suboptimal lending, high non-performing assets, or competitive pressure. Banks with lower NIMs need to reconsider their strategies to improve loan diversification, credit assessment, and interest rate strategies to enhance returns. These findings highlight the importance of efficient asset management in maintaining profitability, adapting to market dynamics, and sustaining a competitive edge in the banking sector.

- **Return on Equity (ROE):** The average ROE, according to the data, was (0.1168679=11.69%), suggesting how well banks used the investments of their shareholders to create earnings. While the maximum attained (0.31502= 31.5%), the minimum ROE noted was (−0.01222 = -1.22%). While the variety of ROE values shows that some banks are effectively managing shareholder funds, others

are not, which could affect investor trust even if the standard deviation of (0.05028346 = 5.03%) suggests small variations among banks.

- **Return on Assets (ROA):** The study revealed that the average ROA was (0.0162694 =1.60%), reflecting a bank's ability to generate profits from its assets efficiently. The lowest ROA recorded was (−0.00199 = - 0.2%), while the highest value was (0.04999 = 5.00%). The existence of low ROA values among some banks points to weaknesses in asset management, emphasizing the need for strategies that optimize asset utilization for better profitability.

- **Non-Performing Loans**: The findings indicated that the average ratio of non-performing loans stood at (0.0823903 = 8.24%), with a minimum value of (0.01625 = 1.62%) and a maximum of (0.22400 = 22.40%). This reveals potential challenges in loan management across banks. The variability in this ratio, indicated by the standard deviation of (0.03820137 = 3.82%), suggests that some banks are more vulnerable to credit risks, highlighting the importance of implementing robust credit risk management practices to safeguard financial stability.

5.3 Results of testing the study hypotheses

Table (5.1) shows a summary of the results of testing the study hypotheses, as follows:

Table (5.1) Summary of the results of the study hypotheses

Study Hypothesis	Result
H01: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks.	**Accept the alternative hypothesis**
H01-1: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).	**Accept the alternative hypothesis**
H01-2: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).	**Accept the alternative hypothesis**
H01-3: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return On Equity (ROE).	**Accept the alternative hypothesis**
H02: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks.	**Accept the alternative hypothesis**
H02-1: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM).	**Accept the alternative hypothesis**
H02-2: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA).	**Accept the alternative hypothesis**
H02-3: There is no statistically significant impact at the significance level (α ≤ 0.05) of Non-Performing Loans on the Profitability of Jordanian Commercial Banks measured by Return on Equity (ROE).	**Accept the alternative hypothesis**
H03: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in technology impact on the Non-Performing Loans.	**Accept the alternative hypothesis.**

Study Hypothesis	Result
H04: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks Considering the Mediating Impact of Non-Performing Loans.	**Accept the alternative hypothesis.**
H04-1: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Net Interest Margin (NIM) Considering the Mediating Impact of Non-Performing Loans.	**Accept the alternative hypothesis.**
H04-2: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return on Assets (ROA) Considering the Mediating Impact of Non-Performing Loans.	**Accept the alternative hypothesis.**
H04-3: There is no statistically significant impact at the significance level (α ≤ 0.05) of investment in Technology on the Profitability of Jordanian Commercial Banks measured by Return on Equity (ROE) Considering the Mediating Impact of Non-Performing Loans.	**Accept the alternative hypothesis.**

5.4 Discussing the results of the study hypotheses

Discussing the results of the study hypotheses is indeed a fundamental aspect of scientific research as it provides a framework for interpreting the data and draws meaningful conclusions that can advise future research and practice. The following are the results of analyzing, testing, and discussing the study hypotheses:

5.4.1 The first main hypothesis

The results of the study showed that at the significance level (α < 0.05), investment in technology has a statistically significant negative impact on the profitability of Jordanian commercial banks, as the F significance threshold is (Sig = 0.00) which is less than (0.05). The study links this outcome to the possibility that some banks might not be investing enough in current technology, therefore compromising their capacity to raise operational profitability and efficiency, banks with low profitability have poor resources

management underscores the importance of improving profitability management strategies. By addressing inefficiencies, diversifying revenue streams, and optimizing asset utilization, banks can enhance their financial performance and competitiveness. The result is consistent with the findings of Thakur, et al. (2023). but inconsistent with Del Gaudio et al. (2021), Entele (2021).

5.4.2 The second main hypothesis

Since the F significance level was (0.000 = Sig), which is less than (0.05), the study revealed that non-performing loans have a statistically significant effect on the profitability of Jordanian commercial banks at the significance level (alpha < 0.05). The report attributes this consequence to elevated levels of non-performing loans, which may lead to increased credit risk and financial losses, so undermining bank profitability. Moreover, the presence of non-performing loans may need increased provisions for loan losses, thereby reducing net income. This underscores the necessity of effective credit risk management measures to mitigate the adverse impacts of non-performing loans on financial performance. The result is consistent with the findings of Nguyen, P. D. (2024), Zabin, S., Hossain, M. & Sultana, A. (2024).

5.4.3 The third main hypothesis

The results of the analysis indicate that a statistically significant impact of technology investment on non-performing loans is observed at the significance level (α <= 0.05). This is due to the fact that the F significance level was (0.000 = Sig), which is less than (0.05). The study posits that this outcome is the consequence of increased technological investment, which enables banks to more effectively assess and manage credit risk. Improved technology tools and processes can enable better monitoring of borrower behavior, more precise risk assessments, and faster reactions to probable loan defaults.

This proactive approach may help to reduce non-performing loan rates, enhancing banks' overall financial stability and performance. The result is consistent with the findings of Thakur et al. (2023) and Nguyen, P. D. (2024)

5.4.4 The fourth main hypothesis

The results of the study indicated that there is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of investment in technology on the profitability of Jordanian commercial banks when considering the mediating impact of non-performing loans. The value of the indirect impact of investment in technology on profitability, with the presence of the mediating variable (NPLs), reached (-0.662), which is a statistically significant impact. The total impact of investment in technology, considering the mediating variable (NPLs), on profitability was (-0.208), suggesting that non-performing loans play an intermediary role in the relationship between investment in technology and profitability.

The researcher attributes this result to the notion that while investment in technology can lead to improved risk management and a reduction in non-performing loans, it may not directly translate into increased profitability. The negative total impact indicates that the costs associated with technological investments might outweigh the immediate benefits, or other factors could be hindering profitability. Additionally, the effectiveness of technology in reducing non-performing loans may take time to manifest fully, suggesting that banks need to strategically align their technological investments with long-term profitability goals. The result is consistent with the findings of Thakur et al. (2023) and Zabin, S., Hossain, M. & Sultana, A. (2024).

5.5 Conclusions

- Many banks are under investing in technology, which affects their operational efficiency and overall profitability.

- There is significant variability in profitability across banks, indicating that some struggle with resource management and require better profitability strategies.

- While the average NIM suggests effective returns, certain banks show inefficiencies in asset management that need to be addressed.

- The range of ROE values indicates discrepancies in managing shareholder funds, impacting investor confidence.

- Low ROA values among some banks highlight weaknesses in asset utilization, necessitating strategies to optimize asset management.

- A notable average of non-performing loans indicates potential credit risk challenges, emphasizing the need for robust credit risk management practices.

- High levels of non-performing loans significantly negatively affect profitability, stressing the importance of effective credit risk management.

- Increased investment in technology is linked to improved management of non-performing loans, suggesting that technology can enhance risk assessment and monitoring capabilities.

5.6 Recommendations

Based on the results reached by the study, the study recommends the following:

- Jordanian commercial banks focus on boosting investment in technological enhancements to improve the profitability of their operations.

- Implement robust practices for assessing and managing credit risk to reduce non-performing loans and invest in training programs to equip employees with the skills necessary to use new technologies and risk management strategies effectively.

- Explore partnerships with FinTech firms to access innovative solutions that enhance efficiency and reduce risks and encourage financial institutions to invest in and develop their banking technology to meet customers' needs and align with rapid changes and digitalization

- The banking sector should pay more attention to disclosing the cost of advanced technology banking services more clearly to reflect a positive image and boost its reputation as a signal and indicator of good performance.

- Increasing customer awareness of high-tech financial services and their benefits, in contrast to traditional services, helps them save time, effort, and cost.

5.7 Future Research Recommendations

- Study the impact of Investment in Technology on financial risks.
- Study the impact of Investment in Technology on operational performance.

References

Adane, M. D., Wale, T., & Meried, E. W. (2021). Determinants of automated teller machine deployment in commercial banks of Ethiopia. Heliyon, 7(e07712). https://doi.org/10.1016/j.heliyon.2021.e07712

Athanasoglou, P. P., Daniilidis, I., & Delis, M. D. (2014). Bank procyclicality and output: Issues and policies. *Journal of Economics and Business*, 72, 58-83. https://doi.org/10.1016/j.jeconbus.2013.10.003

Adeabah, D., Asongu, S., & Andoh, C. (2021). Remittances, ICT and Pension Income Coverage: The International Evidence. *Technological Forecasting and Social Change,* 173, 121148. https://doi.org/10.2139/ssrn.3668982

Al-Jabri, A. Y. (2022). *The impact of technology adoption on the performance of banks: A case study of commercial banks in Qatar* (Master's thesis, Qatar University). Qatar University Institutional Repository. https://qspace.qu.edu.qa/bitstream/handle/10576/44993/ABEER%20YAHYA%20AL-JABRI_OGSApproved_Thesis.pdf?sequence=1&isAllowed=y

Aiken, L. S. (1991). *Multiple regression: Testing and interpreting interactions*. Sage google schola, 2, 103-135.

Association of Banks in Jordan. (2023). *On the occasion of World Banking Day: The Association of Banks in Jordan sheds light on the role of banks in the national economy.*https://abj.org.jo/news/on-the-occasion-of-world-banking-day-the-association-of-banks-in-jordan-sheds-light-on-the-role-of-banks-in-the-national-economy-.

Asongu, S., & Andoh, C. (2021). Remittances, ICT and pension income coverage: The international evidence. *Technological Forecasting and Social Change*, 173, 121148. https://doi.org/10.1016/j.techfore.2021.121148

Almaqtari, F. A., Al-Homaidi, E. A., Tabash, M. I., & Farhan, N. H. (2019). The determinants of profitability of Indian commercial banks: A panel data approach. *International Journal of Finance and Economics*, 24(2), 168–185. https://doi.org/10.1002/ijfe.1652

Al-Amarneh, A., Yaseen, H., Atta, A. B., & Khalaf, L. (2023). Nexus between information technology investment and bank performance: The case of Jordan. *Banks and Bank Systems*, 18(1), 68-76. https://doi.org/10.21511/bbs.18(1).2023.06

Al-Smadi, M. O. (2019). The impact of e-banking on the performance of Jordanian banks. *Journal of Internet Banking and Commerce*, 24(1), 1-15.

Balasubramaniam, C. S. (2012). Non-performing assets and profitability of commercial banks in India: Assessment and emerging issues. *Abhinav National Monthly Refereed *Journal of Research in Commerce & Management*, 1*(3), 41–52.

Baltagi, B. H. (2008). *Econometric analysis of panel data* (4th ed.). John Wiley & Sons.

Barpanda, S., & Athira, S. (2022). Cause of attrition in an information technology-enabled services company: A triangulation approach. *International Journal of Human Capital and Information Technology Professionals (IJHCITP),* 13(1), 1–22. https://www.igi-global.com/article/cause-of-attrition-in-an-information-technology-enabled-services-company/296691

Byrne, B.M. (2010), *Structural equation modeling with AMOS: Basic concepts*, applications, and programming, 2nd ed. (New York : Routledge).

Central Bank of Jordan. (2023). *Annual report. Central Bank of Jordan*. https://www.cbj.gov.jo/EN/List/Annual_Report

Cicchiello, A. F., Cotugno, M., Monferra, S., & Perdichizzi, S. (2021). Exploring the impact of ICT diffusion in the European banking industry: Evidence in the pre- and post-COVID-19. *Journal of Financial Management*, Markets and Institutions, 9(1), 2150010. https://doi.org/10.1142/S2282717X21500102

Corporate Finance Institute. (n.d.). What is return on equity (ROE)? *Corporate Finance Institute.* Retrieved August 6, 2024, from https://corporatefinanceinstitute.com/resources/accounting/what-is-return-on-equity-roe/

Del Gaudio, B. L., Porzio, C., Sampagnaro, G., & Verdoliva, V. (2021). How do mobile, internet and ICT diffusion affect the banking industry? An empirical analysis. *European Management Journal*, 39, 327–332. https://www.sciencedirect.com/science/article/abs/pii/S0263237320301122

Espinoza, R. A., & Prasad, A. (2010). Nonperforming loans in the GCC banking system and their macroeconomic effects (IMF Working Paper No. WP/10/224). *International Monetary Fund*. https://www.imf.org/external/pubs/ft/wp/2010/wp10224.pdf

Entele, B. R. (2021). Impact of institutions and ICT services in avoiding resource curse: Lessons from the successful economies. *Heliyon*, 7(2), e05961. https://doi.org/10.1016/j.heliyon.2021.e05961

FinTech. (2023). Financial technology and innovation sustainable development. *FinTech,* 2(3), 527–542. https://doi.org/10.3390/fintech2030030

Giglio, S. (2021). Fintech: A literature review. *European Research Studies Journal*. Retrieved from: https://scholar.archive.org/work/35eg7pttzvamhidmmbwaugwety/access/wayback/https://www.ersj.eu/journal/2254/download

Gaur, D., & Mohapatra, D. R. (2021). Non-performing assets and profitability: Case of Indian banking sector. *Vision*, 25(2), 180–191. https://doi.org/10.1177/0972262921991081

Goddard, J., Molyneux, P., & Wilson, J. O. S. (2004). Dynamics of growth and profitability in banking. *Journal of Money, Credit and Banking*, 36(6), 1069-1090. https://doi.org/10.1353/mcb.2005.0015

Gyongyosi, L., & Imre, S. (2019). A survey on quantum computing technology. *Computer Science Review*, 31, 51-71. https://doi.org/10.1016/j.cosrev.2018.11.002

Huang, M. H., & Rust, R. T. (2021). Engaged to a robot? The role of AI in service. *Journal of Service Research*, 24(1), 30-41. https://journals.sagepub.com/doi/10.1177/1094670520902266

Huiyu, L., Zhang, Z., Chen, Y., & Chen, Y. (2023). How FinTech improves financial reporting quality? Evidence from earnings management. *Economic Modelling*. https://doi.org/10.1016/j.econmod.2023.106076

Kanoujiya, J., Bhimavarapu, V. M., & Rastogi, S. (2023). Banks in India: A Balancing Act Between Profitability, Regulation and NPA. *Vision*, 27(5), 650-660. https://doi.org/10.1177/09722629211034417

Kanoujiya, J., & Rastogi, S. (2022). Impact of market competitiveness and risk management of NPAs of Indian banks on its efficiency. *International Journal of Monetary Economics and Finance,* 15 (2), 173–193. https://ideas.repec.org/a/ids/ijmefi/v15y2022i2p173-193.html

Kanoujiya, J., Bhimavarapu, V. M., & Rastogi, S. (2021). Banks in India: A balancing act between profitability, regulation and NPA. *Vision*, 25(4), 515–526. https://doi.org/10.1177/09722629211034417

Kenton, W. (2023). *Efficiency ratio. Investopedia*. https://www.investopedia.com/terms/e/efficiencyratio.asp

Khan, H. R., & Asghar, M. S. (2022). Digital banking in the era of COVID-19. *Journal of Financial Services Marketing,* 27(1), 22-30. https://doi.org/10.1057/s41264-021-00100-5

Makri, V., Tsagkanos, A., & Bellas, A. (2014). Determinants of non-performing loans: The case of Eurozone. *Panoeconomicus*, 61(2), 193-206. https://doi.org/10.2298/PAN1402193M

Mashal, A. (2006). Impact of information technology investment on productivity and profitability: The case of a leading Jordanian bank. *Journal of Information Technology Case and Application Research*, 8*(4), 25–46. https://doi.org/10.1080/15228053.2006.10856099

Nguyen, P. D. (2024). Non-performing loans and bank profitability: evidence from Vietnam. *Macroeconomics and Finance in Emerging Market Economies*, 1-21. https://doi.org/10.1080/17520843.2024.2318927.

Schaltegger, S., & Hörisch, J. (2015). In search of the dominant rationale in sustainability management: Legitimacy- or profit-seeking? *Journal of Business Ethics*, 145(2), 259-276. https://www.researchgate.net/publication/282851110_In_Search_of_the_Dominant_Rationale_in_Sustainability_Management_Legitimacy-_or_Profit-Seeking

Scott, S. V., Van Reenen, J., & Zachariadis, M. (2017). The long-term effect of digital innovation on bank performance: An empirical study of SWIFT adoption in financial services. *Research Policy*, 46(5), 984–1004. https://doi.org/10.1016/j.respol.2017.03.010

Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind Bitcoin is changing money, business, and the world*. Penguin Publishing Group https://books.google.jo/books/about/Blockchain_Revolution.html?id=NqBiCgAAQBAJ&redir_esc=y

Teece, D. J. (2018). Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy,* 47(8), 1367-1387. https://doi.org/10.1016/j.respol.2017.01.015

Thakur, S., Rastogi, S., Parashar, N., Tejasmayee, P., & Kappal, J. M. (2023). The impact of ICT on the profitability of Indian banks: The Moderating role of NPA. *Journal of Risk and Financial Management*, 16(4), 211. https://doi.org/10.3390/jrfm16040211

Ugwuanyi, A., Eze, M. E., Obi, I. C., & Ugwuanyi, E. I. (2013). Open access to knowledge: Perception of librarians in colleges of education in South-East Nigeria. *Journal of Educational and Social Research*, 3(4), 29-35.

Wall Street Prep. (n.d.). *Net interest margin (NIM).* https://www.wallstreetprep.com/knowledge/net-interest-margin-nim/

World Bank. (2023). *Jordan economic monitor: Unlocking the potential of digital finance.* World Bank Group. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099603312182322486/idu0056e275100e7a04ea1088b00c4b24ebf37c8

Wang, Y., Xiuping, S., & Zhang, Q. (2021). Can fintech improve the efficiency of commercial banks?—An analysis based on big data. *Research in International Business and Finance,* 55, 101338. https://doi.org/10.1016/j.ribaf.2020.101338

Wen, C., Yang, J., Gan, L., & Pan, Y. (2021). Big data driven Internet of Things for credit evaluation and early warning in finance. *Future Generation Computer Systems,* 124, 295–307.

https://www.sciencedirect.com/science/article/abs/pii/S0167739X21001977

Zabin, S., Hossain, M. & Sultana, A. (2024). Impact of Non-Performing Loans on Bank Profitability: A Study of Rupali Bank PLC, Bangladesh, *International Journal of Science and Business*, 42(1), 159-174.

Zuo, L., Strauss, J., & Zuo, L. (2021). The digitalization transformation of commercial banks and its impact on sustainable efficiency improvements through investment in science and technology. *Sustainability*, 13(19), Article 11028. https://doi.org/10.3390/su131911028

Internet Refrences:

Central Bank of Jordan:

https://statisticaldb.cbj.gov.jo/?node=UjltbEYyYVRMK3lZelRYTis4blJTQT09#dataArea

Appendix

Appendix 1 Eviews and AMOS Outcomes

Descriptive Statistics

	ITINV	ROA	ROE	NIM	NPL
Mean	0.568771	0.016269	0.116868	0.030961	0.082392
Median	0.576400	0.016210	0.118535	0.029876	0.075000
Maximum	0.952300	0.049990	0.315018	0.058347	0.224000
Minimum	0.074700	-0.001990	-0.012223	0.011162	0.016000
Std. Dev.	0.201336	0.007799	0.050283	0.007801	0.038210
Skewness	-0.300734	0.592986	0.299753	0.599192	1.241978
Kurtosis	2.438032	4.952416	4.451138	4.145385	5.273021
Jarque-Bera	4.037204	31.09332	14.68854	16.37368	67.54759
Probability	0.132841	0.000000	0.000646	0.000278	0.000000
Sum	81.33420	2.326490	16.71211	4.427420	11.78200
Sum Sq. Dev.	5.756142	0.008638	0.359037	0.008642	0.207322
Observations	143	143	143	143	143

Correlation							
t-Statistic							
Probability	ITINV	ROA	ROE	NIM	NPL	SIZE	PROFITABILITY
ITINV	1.000000						
ROA	0.084575	1.000000					
	1.007886	-----					
	0.3152	-----					
ROE	0.070169	0.921141	1.000000				
	0.835274	28.10166	-----				
	0.4050	0.0000	-----				
NIM	0.071635	0.711475	0.629481	1.000000			
	0.852807	12.02241	9.619711	-----			
	0.3952	0.0000	0.0000	-----			
NPL	-0.045807	-0.253863	-0.381991	-0.073440	1.000000		
	-0.544505	-3.116560	-4.908095	-0.874410	-----		
	0.5870	0.0022	0.0000	0.3834	-----		
PROFITABILITY	0.075498	0.949018	0.992130	0.715768	-0.346105	0.035553	1.000000
	0.899059	35.74927	94.08681	12.17071	-4.380498	0.422438	-----
	0.3702	0.0000	0.0000	0.0000	0.0000	0.6733	-----

Table (4.2): Results of the simple regression analysis of the investment in technology on the profitability

Dependent Variable: PROFITABILITY
Method: Panel Least Squares
Date: 02/01/25   Time: 11:37
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITINV	-0.003419	0.004993	-0.684726	0.4948
PROFITABILITY(-1)	0.726206	0.051522	14.09506	0.0000
C	0.014338	0.003859	3.715574	0.0003

R-squared	0.550766	Mean dependent var		0.053748
Adjusted R-squared	0.543692	S.D. dependent var		0.019624
S.E. of regression	0.013256	Akaike info criterion		-5.785954
Sum squared resid	0.022316	Schwarz criterion		-5.719780
Log likelihood	379.0870	Hannan-Quinn criter.		-5.759065
F-statistic	77.85175	Durbin-Watson stat		1.722501
Prob(F-statistic)	0.000000			

Table (4.3): Results of the simple regression analysis of the Investment in Technology on Net Interest Margin (NIM)

Dependent Variable: NIM
Method: Panel Least Squares
Date: 01/31/25   Time: 22:34
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITINV	0.001575	0.001676	0.939584	0.3494
C	0.007512	0.001754	4.283853	0.0000
NIM(-1)	0.715157	0.051388	13.91671	0.0000

Effects Specification				

Cross-section fixed (dummy variables)

R-squared	0.903012	Mean dependent var		0.030738
Adjusted R-squared	0.891204	S.D. dependent var		0.007660
S.E. of regression	0.002526	Akaike info criterion		-9.015847
Sum squared resid	0.000734	Schwarz criterion		-8.684977
Log likelihood	601.0300	Hannan-Quinn criter.		-8.881403
F-statistic	76.47930	Durbin-Watson stat		2.124686
Prob(F-statistic)	0.000000			

Table (4.4): Results of the simple Regression analysis of the Investment in Technology on Return on Assets (ROA)

Dependent Variable: ROA
Method: Panel Least Squares
Date: 01/31/25   Time: 22:12
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITINV	-0.001084	0.001913	-0.566978	0.5717
C	0.003578	0.001326	2.698901	0.0079
ROA(-1)	0.756379	0.053120	14.23910	0.0000

R-squared	0.577359	Mean dependent var	0.015929
Adjusted R-squared	0.570703	S.D. dependent var	0.007395
S.E. of regression	0.004845	Akaike info criterion	-7.798789
Sum squared resid	0.002982	Schwarz criterion	-7.732615
Log likelihood	509.9213	Hannan-Quinn criter.	-7.771900
F-statistic	86.74573	Durbin-Watson stat	1.723872
Prob(F-statistic)	0.000000		

Table (4.5) Results of simple regression Analysis of the Investment in Technology on Return on Equity (ROE)

Dependent Variable: ROE
Method: Panel Least Squares
Date: 01/31/25   Time: 22:19
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITINV	-0.008119	0.015125	-0.536759	0.5924
C	0.035385	0.011273	3.138988	0.0021
ROE(-1)	0.684157	0.063604	10.75655	0.0000

R-squared	0.478879	Mean dependent var	0.114576
Adjusted R-squared	0.470672	S.D. dependent var	0.047113
S.E. of regression	0.034277	Akaike info criterion	-3.885895
Sum squared resid	0.149211	Schwarz criterion	-3.819721
Log likelihood	255.5832	Hannan-Quinn criter.	-3.859006
F-statistic	58.35259	Durbin-Watson stat	1.689369
Prob(F-statistic)	0.000000		

Table (4.6): Results of the simple regression analysis of Non-Performing Loans on Profitability

Dependent Variable: PROFITABILITY				
Method: Panel Least Squares				
Date: 02/01/25 Time: 18:09				
Sample (adjusted): 2011 2020				
Periods included: 10				
Cross-sections included: 13				
Total panel (balanced) observations: 130				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL	-0.082088	0.033642	-2.440032	0.0161
PROFITABILITY(-1)	0.680689	0.059081	11.52121	0.0000
C	0.021518	0.005001	4.302866	0.0000
R-squared	0.569727	Mean dependent var		0.053748
Adjusted R-squared	0.562951	S.D. dependent var		0.019624
S.E. of regression	0.012973	Akaike info criterion		-5.829077
Sum squared resid	0.021374	Schwarz criterion		-5.762903
Log likelihood	381.8900	Hannan-Quinn criter.		-5.802189
F-statistic	84.08061	Durbin-Watson stat		1.681614
Prob(F-statistic)	0.000000			

Table (4.7): Results of the simple regression analysis of Non-Performing Loans on Net Interest Margin (NIM)

Dependent Variable: NIM
Method: Panel EGLS (Cross-section random effects)
Date: 02/01/25   Time: 18:13
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
Swamy and Arora estimator of component variances
Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL	-0.006867	0.006629	-1.035865	0.3022
NIM(-1)	0.885927	0.032327	27.40548	0.0000
C	0.003644	0.001039	3.506016	0.0006

Effects Specification				
			S.D.	Rho
Cross-section random			0.000514	0.0394
Idiosyncratic random			0.002537	0.9606

Weighted Statistics				
R-squared	0.850936	Mean dependent var		0.025879
Adjusted R-squared	0.848589	S.D. dependent var		0.006763

S.E. of regression	0.002632	Sum squared resid		0.000880
F-statistic	362.4919	Durbin-Watson stat		2.073409
Prob(F-statistic)	0.000000			

Unweighted Statistics			

R-squared	0.878923	Mean dependent var	0.030738
Sum squared resid	0.000916	Durbin-Watson stat	1.990062

Table (4.8) Results of the simple regression analysis of Non-Performing Loans on Return on Assets (ROA)

Dependent Variable: ROA
Method: Panel EGLS (Cross-section random effects)
Date: 02/01/25   Time: 18:16
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
Swamy and Arora estimator of component variances
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL	-0.016505	0.011211	-1.472284	0.1434
ROA(-1)	0.736277	0.060708	12.12816	0.0000
C	0.004616	0.001456	3.170116	0.0019

Effects Specification				
			S.D.	Rho
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.004871	1.0000

Weighted Statistics			

R-squared	0.582471	Mean dependent var	0.015929
Adjusted R-squared	0.575896	S.D. dependent var	0.007395
S.E. of regression	0.004816	Sum squared resid	0.002946
F-statistic	88.58539	Durbin-Watson stat	1.693764
Prob(F-statistic)	0.000000		

Unweighted Statistics			

R-squared	0.582471	Mean dependent var	0.015929
Sum squared resid	0.002946	Durbin-Watson stat	1.693764

Table (4.9): Results of the simple regression analysis of Non-Performing Loans on Return on Equity (ROE)

Dependent Variable: ROE
Method: Panel Least Squares
Date: 02/01/25   Time: 18:17
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL	-0.247680	0.087537	-2.829446	0.0054
ROE(-1)	0.619741	0.064657	9.585113	0.0000
C	0.058392	0.012511	4.667378	0.0000

R-squared	0.508669	Mean dependent var	0.114576
Adjusted R-squared	0.500931	S.D. dependent var	0.047113
S.E. of regression	0.033283	Akaike info criterion	-3.944759
Sum squared resid	0.140682	Schwarz criterion	-3.878585
Log likelihood	259.4094	Hannan-Quinn criter.	-3.917871
F-statistic	65.74068	Durbin-Watson stat	1.643478
Prob(F-statistic)	0.000000		

Table (4.10): Results of the regression analysis of the Investment in Technology on Non-Performing Loans

Dependent Variable: NPL
Method: Panel Least Squares
Date: 02/01/25   Time: 18:59
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 13
Total panel (balanced) observations: 130
White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ITINV	0.005334	0.010365	0.514649	0.6078
NPL(-1)	0.698650	0.104248	6.701818	0.0000
C	0.018739	0.010167	1.843115	0.0679

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.738260	Mean dependent var	0.079969
Adjusted R-squared	0.706396	S.D. dependent var	0.035405
S.E. of regression	0.019184	Akaike info criterion	-4.961269
Sum squared resid	0.042325	Schwarz criterion	-4.630399
Log likelihood	337.4825	Hannan-Quinn criter.	-4.826825
F-statistic	23.16912	Durbin-Watson stat	1.813985
Prob(F-statistic)	0.000000		

H04

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	9
Number of distinct parameters to be estimated:	9
Degrees of freedom (9 - 9):	0

Result (Default model)

Minimum was achieved

Chi-square = .000

Degrees of freedom = 0

Probability level cannot be computed

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	.000	0		
Saturated model	9	.000	0		
Independence model	6	33.739	3	.000	11.246

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.007	.989	.944	.389
Saturated model	.000	1.000		
Independence model	.072	.569	.198	.367

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	1.000		1.000		1.000
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.000	.000	.000
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	.000	.000	.000
Saturated model	.000	.000	.000
Independence model	30.739	15.642	53.283

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.000	.000	.000	.000
Saturated model	.000	.000	.000	.000
Independence model	.238	.216	.110	.375

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Independence model	.033	.192	.354	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	18.000	18.522		
Saturated model	18.000	18.522		
Independence model	45.739	46.087		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.127	.127	.127	.130
Saturated model	.127	.127	.127	.130
Independence model	.322	.216	.481	.325

HOELTER

Model	HOELTER .05	HOELTER .01
Default model		
Independence model	33	48

Scalar Estimates (Group number 1 - Default model)

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
NPLs	<---	Tech_inv	3.178	.834	3.809	***	
Profitability	<---	NPLs	-.208	.045	-4.624	***	
Profitability	<---	Tech_inv	.634	.470	1.348	.178	

Means: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Tech_inv	.005	.000	14.769	***	

Intercepts: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
NPLs	.068	.005	14.038	***	
Profitability	.069	.004	17.162	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Tech_inv	.000	.000	8.426	***	
e2	.001	.000	8.426	***	
e3	.000	.000	8.426	***	

Matrices (Group number 1 - Default model)

Total Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	3.178	.000
Profitability	-.028	-.208

Direct Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	3.178	.000
Profitability	.634	-.208

Indirect Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	.000	.000
Profitability	-.662	.000
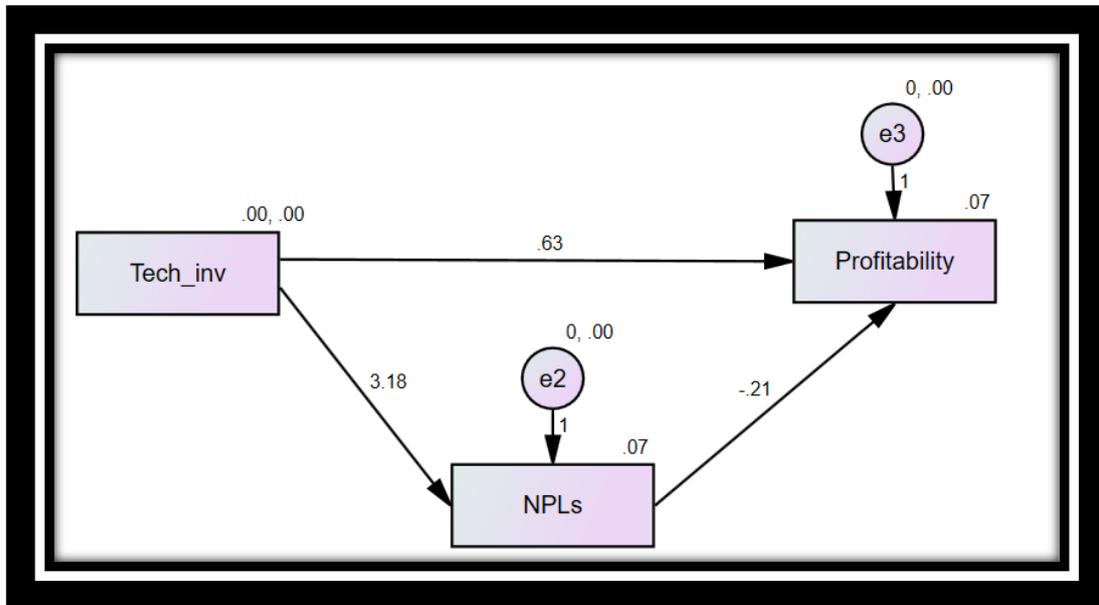
Notes for Model (Default model)

Computation of degrees of freedom (Default model)

  Number of distinct sample moments: 20

  Number of distinct parameters to be estimated: 17

  Degrees of freedom (20 - 17):   3

Result (Default model)

Minimum was achieved

Chi-square = 372.046

Degrees of freedom = 3

Probability level = .000

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	13	9.770	3	.282	3.221
Saturated model	21	.000	0		
Independence model	6	435.936	15	.000	29.062

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.005	.979	.944	.373
Saturated model	.000	1.000		
Independence model	.065	.424	.194	.303

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.978	.958	.996	.992	.996
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.533	.521	.531
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	1.770	.000	13.944
Saturated model	.000	.000	.000
Independence model	420.936	356.509	492.782

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.065	.012	.000	.092
Saturated model	.000	.000	.000	.000
Independence model	2.887	2.788	2.361	3.263

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.038	.000	.107	.535
Independence model	.431	.397	.466	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	35.770	37.034	75.081	88.081

Model	AIC	BCC	BIC	CAIC
Saturated model	42.000	44.042	105.501	126.501
Independence model	447.936	448.519	466.079	472.079

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.237	.225	.318	.245
Saturated model	.278	.278	.278	.292
Independence model	2.966	2.540	3.442	2.970

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	240	311
Independence model	9	11

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
NPLs	<---	Tech_inv	3.178	.834	3.809	***	
NIM	<---	NPLs	-.023	.018	-1.315	.189	
ROA	<---	NPLs	-.057	.017	-3.259	.001	
ROE	<---	NPLs	-.545	.107	-5.117	***	
NIM	<---	Tech_inv	.292	.186	1.570	.116	
ROA	<---	Tech_inv	.161	.181	.888	.374	
ROE	<---	Tech_inv	1.449	1.112	1.303	.193	

Means: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Tech_inv	.005	.000	14.769	***	

Intercepts: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
NPLs	.068	.005	14.038	***	
NIM	.032	.002	19.888	***	
ROA	.020	.002	13.049	***	
ROE	.155	.010	16.331	***	

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Tech_inv	.000	.000	8.426	***	
e1	.001	.000	8.426	***	
e2	.000	.000	8.426	***	
e4	.000	.000	8.426	***	
e5	.002	.000	8.426	***	

Matrices (Group number 1 - Default model)

Total Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	3.178	.000
ROE	-.284	-.545
ROA	-.019	-.057
NIM	.217	-.023

Direct Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	3.178	.000
ROE	1.449	-.545
ROA	.161	-.057
NIM	.292	-.023

Indirect Impacts (Group number 1 - Default model)

	Tech_inv	NPLs
NPLs	.000	.000
ROE	-1.732	.000
ROA	-.180	.000
NIM	-.074	.000