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The Impact of AI on Real-Time Payments (RTP) for Small and Medium-Scale Enterprises' Performance in the United States of America

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Abstract

This study evaluated the impact of Ai on real time payment (RTP) for small and medium scale enterprises performance in United States of America with the aim of answering the research questions on how AI technologies adopted by US SMEs have facilitated access of payment rate, the extent at which AI technology impact the performance of US SMEs using a literature review approach. Findings from the analysed data confirmed that the rate of digital payments transactions in the US is growing on a fast rate which was also confirmed by recent empirical studies conducted after 2020 period stressing that the adoption of AI technologies by U.S. SMEs significantly impacts their access to payment rates particularly during the periods after the pandemic. This study also revealed that the impact of AI on the performance of SMEs in the United State appears to be unstable with the sampled periods of 2019 to 2024 with larger percentage of the sampled respondents in 2024 indicating that their business was in a favourable condition. On the final note, the findings revealed that the integration of artificial intelligence (AI) technology significantly enhances risk management for small and medium-sized enterprises (SMEs) in the US majorly in terms of influencing informed decision making, operational efficiency and response to market fluctuations. This study thereby recommended that SMEs in US should keep adopting AI technology for transaction processing, decision making, market forecast, fraud detection, compliance processes, credit risk management, data quality monitoring and operational resilience.

Keywords: AI; Real Time Payment System (RTPs); SMEs; General-Purpose Technology (GPT); Risk management

1. Introduction

The United States' financial system performs millions of transactions every day, facilitating purchases and payments using a variety of techniques, including checks, drafts, and electronic money transfers [15]. Small firms, which play an important role in community development by producing jobs, have greater failure rates than bigger enterprises. Given their enormous economic impact and increased danger of failure, it is critical to investigate ways to ensure their survival [45]. Technological developments, particularly the introduction of real-time payment (RTP) systems in the US banking sector, offer the promise of expediting cash flow throughout the business cycle, thereby improving the performance and sustainability of small firms.

The explosive rise of AI-powered big data solutions is causing a revolution in the financial services industry. These technologies improve risk management skills, make it easier to extract insightful information, and help businesses make wiser decisions. AI is being used by payment networks and financial organizations, which manage enormous volumes of data, to provide new opportunities [58]. At the same time, real-time payment (RTP) systems are becoming more and more popular due to the growing e-commerce industry and the widespread usage of smart devices. These developments are especially helpful to small and medium-sized businesses (SMEs) in the US. AI-driven insights help SMEs become

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more competitive by helping them manage risks more skillfully, streamline their operations, and make data-driven choices. These companies can respond more quickly to market needs and manage cash flow better because of RTP systems, which provide them instant access to capital. These methods make it possible for money to be transferred instantly, which is very convenient but also raises questions about data security and the susceptibility of the system to dangers like money laundering and identity theft.

Small and medium-sized businesses are essential to the American economy because they provide jobs and foster community growth. SMEs fail at a greater rate than bigger companies, even though they are more important. About 30% of SMEs fail in the first two years, and about 50% fail in the first five [41]. This high failure rate makes it clear that creative solutions are required to promote the expansion and sustainability of SMEs. Technological developments provide promising paths to addressing these issues, especially in the financial industry. RTP solutions might be used to improve cash flow during the business cycle, which could boost SMEs' performance and survival rates.

AI has completely changed the way businesses operate by automating repetitive processes and freeing up human resources to work on more significant projects [58]. Artificial intelligence (AI)-driven solutions improve accuracy and efficiency for a variety of jobs, from straightforward data entry to intricate supply chain management procedures. For example, predictive algorithms can foresee disturbances and provide mitigations, revolutionizing the way firms run. Furthermore, AI-powered analytics outperform human analysts in terms of analytical capacity and greatly improve decision-making processes by yielding profound insights from massive datasets. The use of artificial intelligence (AI) has resulted in the creation of creative consumer products and business models, radically changing the nature of corporate operations [85]. The potential of artificial intelligence (AI) has been further enhanced by generative AI technologies. Since the introduction of Generative Adversarial Networks (GANs) in 2014, artificial intelligence (AI) has been able to produce remarkably lifelike pictures, movies, and audio files. These technologies spur innovation and open up previously unimaginable opportunities by empowering businesses to develop new products and services.

The Federal Reserve (Fed) declared in August 2019 that it would establish an interbank real-time payments (RTP) system by 2023 or 2024, [15]. According to the Fed, all banks that have a reserve account at the Fed will be allowed to use the new system, and those that do so will have to make the cash accessible to their clients as soon as they get notification of settlement. Some private sector projects are also in motion to expedite payments; these initiatives range from ones that would give real-time settlement to others to ones that would make monies accessible to the receiver immediately (with delayed settlement). Faster cash transfers would be advantageous for both customers and businesses, especially because an increasing percentage of payments are being performed online or via mobile devices. Given that comparable private-sector activity is already underway, the primary policy question about the Federal Reserve and RTP is whether Fed entry into this market is desirable. Regarding cost, efficiency, safety, innovation, ubiquity, and financial stability, there is disagreement on whether Fed competition would be advantageous.

1.1. Problem Statement

Small and medium-sized enterprises (SMEs) in the United States face a myriad of challenges that threaten their sustainability and growth [23]. Despite their crucial role in driving economic development, creating jobs, and fostering innovation, SMEs are particularly vulnerable to market volatility, limited access to financing, and operational inefficiencies [48]. The rapid advancement of technology, especially in the field of artificial intelligence (AI), presents a significant opportunity to address these challenges. However, there is a substantial gap in understanding how AI-powered real-time payment (RTP) systems can be effectively integrated into SME operations to enhance their resilience and long-term performance and success [11, 71].

The relevance of this study stems from its ability to solve major difficulties confronting SMEs in the United States economy as small and medium-sized enterprises (SMEs) play an important role in economic development by creating jobs and growing communities [26, 88]. However, their greater sensitivity to failure needs a better understanding of how technological developments, particularly AI-powered RTP systems, might help them survive and flourish as AI's capacity to automate mundane processes, foresee disruptions, and extract meaningful insights from vast datasets has the potential to alter how SMEs operate, allowing them to respond more quickly to market needs and manage cash flow more effectively [25, 32]. Hence, this study fills these knowledge gap by shedding more light on how AI technologies could impact US SMEs business operations, growth and performance and the how it could influence SMEs level of risk management.

1.2. Objectives of the Study

The main objective of this study is to the impact of ai on real time payment (RTP) for small and medium scale enterprises performance in United States of America. Specifically, this study seeks to:

- Evaluate the impact of AI technologies adopted by US smes on access of payment rate.
- Examine the impact of AI technology on the performance of US smes.
- Assess the impact of AI technology on US smes risk management.

1.3. Research Questions

The following research questions are prominent for this study;

- How has AI technologies impacted US smes access of payment rate.
- What is the impact of AI technology on the performance of US smes.
- To what extent as AI technology impacted US smes risk management.

1.4. Significance of the Study

The significance of this study lies in its potential to make substantial contributions to both academic research and practical applications in the realm of small and medium-sized enterprises (SMEs). By exploring the impact of AI-powered real-time payment (RTP) systems on SMEs in the United States, this research offers valuable insights that can guide business owners, policymakers, and technology developers in harnessing the full potential of AI innovations. This study addresses a critical gap in existing literature by providing empirical evidence on the effectiveness of AI and RTP technologies in improving SME performance. Understanding how these technologies can streamline operations, enhance risk management, and support data-driven decision-making will contribute to the broader field of business technology integration and innovation management.

The findings of this study have practical implications for SME owners and managers, informing strategic decision-making and helping develop more effective technology adoption strategies. This can lead to increased efficiency, reduced operational costs, and improved financial health, ultimately contributing to the sustainability and growth of SMEs. Additionally, policymakers can leverage the insights gained from this research to design supportive measures, such as financial incentives and training resources, facilitating the adoption of AI and RTP technologies among SMEs. By enhancing the competitiveness and resilience of SMEs, this study supports job creation, community development, and overall economic growth, highlighting the intrinsic link between SME success and the nation's economic health and prosperity.

1.5. Scope of the Research

The purpose of this research work is therefore to investigate the impact of AI technologies on small and medium-scale enterprises (SMEs) operating within the United States. The scope of this work is to evaluate how AI technologies impact access of payment rate, the performance and risk management by US SMEs in pre and post covid-19 period. The data for this study was sourced from Statista, publications, academic journals and other reliable industries reports like… among others to ensure wide data coverage and incorporate recent happenings as AI adoption spreads.

1.6. Structure of the Research

The subsequent sections of this study are structured as follows: section2 explores the economic implications of AI on small and medium-sized enterprises in the United Kingdom, as well as the main concepts and theories that underlie it. Sections 3 covers the research methodology, including design, data methods, sampling, analysis and ethical considerations. Section4 was dedicated to data presentation and analysis with the interpretation and discussion of the research findings. Finally, sections 5 provide the summariess and conclusions of the study and also provide recommendations for small and medium-sized enterprises (SMEs) in the United States as regard the use of AI technologies.

2. Literature review

2.1. Advancement in Technology AI

Technological capability is usually embedded in new products or technologies that are evaluated as a 'leap forward,' or as discontinuities Levin, 2018; Tushman & Anderson, 2018). The modern Economics literature often employs this idea of technology advancement though, not always accurate though as where technology advancement is concerned, there are way to depict it as progressive refinement within a specific sector or to perform a specific process in a unique way [31].

AI technology, in particular, exemplifies this concept of advancement through both significant leaps and continuous refinements 'Jacobides, [30]'. Over the past decade, AI has evolved from theoretical frameworks and experimental applications to a practical and indispensable tool across various industries [10]. Innovations such as machine learning algorithms, natural language processing, and computer vision have enabled AI to perform complex tasks with high efficiency and accuracy [66]. These advancements have not only transformed sectors like healthcare, finance, and manufacturing but have also introduced new paradigms in business operations and consumer interactions, demonstrating the multifaceted nature of technological progress in AI.

2.2. Real Time Payment System (RTPs)

The Real Time Payment System (RTPS) is not new since the Zengin Systems was founded in 1973 in Japan. Moving forward, more RTPS installations have been reported in several countries recently especially at the end of the year 2010. This is the case mainly due to the fact that customers have started becoming used to the fast and readily available information that the advent of the mobile revolution presents [37]. Banks and businesses cannot afford to fail in being able to provide services that accommodate payment systems that are faster any time and any place as real time e-commerce and m-commerce purchases are made demanding timely delivery [44].

The US Faster Payment System (FPS) was launched in the year 2008 and is among one of the most popular types of Real-Time Payment Systems (RTPS) as it has characteristics of an RTPS that most countries would desire to have or be associated with 'Pay.US, [63]'In June 2024, Faster Payments processed 391.8 million payments, which is a 3% increase compared to June 2023. These payments amounted to a total of £323 billion for the month 'Pay.US, [63]'. Nevertheless, since RTPS has the capacity to reduce on other source of income such as card and float fees, the entire banking industry does not consider RTPS to be strongly economically justified 'Morris [54]'. In the case of RTPS, it postulates that RTPS increases the public goods as it fosters enhanced risk management, cost optimization, and competitiveness in payment services businesses 'Morris [54]'.

Nevertheless, the implementation of RTPS depends on the fact that the country already has a good market infrastructure that responds to the CPMI requirements for the minimization of systemic risks 'Shen [72]'. For the emerging nations, this system is not entirely acceptable due to the capacity to apply such technologies which may not be feasible for the near future in terms of both fiscal and pragmatic execution capabilities 'Saridha [68]'Publication and world-wide availability of RTPS is not at a low cost and as a result, it can only be attempted with a quite sizable number of institutions coming forward to share the costs 'Lin et al. [39]'

2.3. SMES in USA

SMEs in the United States include organizations employing less than 500 people; this forms 85% of the enterprises in the United States of America and 80% of the global companies. Given their large population, SMEs' contribution to the degradation of the environment is profound. In a pre-post comparison study carried out on 584 US manufacturing firms "Lin and Liu [40] compared the levels of recycling before and after undergoing ISO 14001 certification. Of 177 respondents, their study proved that the organisations of small scales have resulted in enhanced performance in recycling, thus supporting the role of EMS on SMEs.

To build the propositions, Manring and Moore [47] developed a conceptual framework of Building Virtual Inter-Organizational Learning Networks for Greener Production Using Systems Thinking. Their north Carolina's textile industry case study on addressing aquatic toxicity regulation. The webs of stakeholders that include regulatory agencies, the local government, industries, engineers, NGOs, and the community ensured acceptable solutions to implement on the textile sectors while recognizing implementation challenges.

Hussey and Eagan [28] analyzed the environmental performance of the 458 small manufacturers of U. S through SEM. The analytical tools part of SEM, which includes various methods of statistics, appeared helpful in defining areas that require enhancement. Moore and Manring also discovered that as compared to MNEs, SMEs as first movers are relatively more flexible and sensitive to competition pressures, and therefore, can embrace sustainability better. Advanced communication technologies have also facilitated the formation of networks of the SMEs thus improving on its market standing and resource mastery.

2.4. AI and Real Time Payment System

An AI integration of the payment has led to the complete disruption of traditional payment methods [78]. These advancements paved a way to significant changes on the traditional payment system schemes as they improved on its security, efficacy, and individuality in monetary exchanges. Safety is one of the most important elements in the

settlement's electronic environment, because cyberspace is filled with threats and fraudulent actions. The AI-based solutions offer a preventive defense platform by employing intelligent programs that scrutinize big volumes of transactions in real-time [4]. With the help of repetitive pattern identification and outlier decision, these algorithms can immediately distinguish suspicious procedures like out-of-character buying or login attempts. Thanks to the ability of the AI, such irregularities are reported immediately helping the financial institutions to curtail the threats and safeguard the customers' wealth [42].

Also, the application of artificial intelligence in the form of chatbots and virtual assistants has proved to be crucial in improving the mode of customer engagement in the payments space [36]. These intelligent agents use NLP algorithms to interact with the users through conversational interfaces and provide users real-time assistance and recommendation services [2]. Regardless of the latter, AI-driven chatbots can resolve queries ranging from account information, fund transfers, or clearance to payment-related questions through efficient and round-the-clock customer service [21].

In addition, these virtual assistants have dynamic features where they learn from users' interactions with them over time and provide the corresponding experiences for each user [77]. Thus, customization is the foundational element of artificial intelligence integration into payments as financial organizations embrace constant changes in consumers' demand [51] Appending the current transactions, spending trends and demography, the AI algorithms come up with business insights about the customer trends and preferences. Consequently, firms in the financial sector may set up offers, promotions thus products for individual customers that are very unique and specific to each of them [46]. To achieve greater satisfaction and increased lock-in of customers' business, financial institutions should strive to manage services in accordance with the needs of each segment. Moreover, AI technologies have the potential to streamline the payment process itself, making it faster, more convenient, and frictionless for users [83].

2.5. Effect of Real Time Payment System for SMEs in USA

Small and Medium-sized Enterprises (SMEs) play a crucial role in the U.S. economy, contributing significantly to employment and economic growth. The advent of real-time payment systems (RTPS) has introduced a paradigm shift in financial transactions, potentially offering substantial benefits to SMEs. Several studies highlight the impact of RTPS on the operational efficiency of SMEs. Real-time payments streamline the transaction process, reducing the time lag between sending and receiving payments. According to Buckley and Balakrishnan [13], real-time payments eliminate reconciliation delays and reduce the burden of manual processing, allowing businesses to allocate resources more effectively. This efficiency is particularly beneficial for SMEs with limited administrative staff, enabling them to focus on core business activities.

Real-time payment systems also significantly influence the financial management of SMEs. Immediate access to funds enhances cash flow management, a critical aspect for small businesses that often face liquidity constraints. Vawter [76] reports that real-time payments provide SMEs with better control over their finances, reducing reliance on credit lines and lowering interest expenses. Enhanced cash flow visibility allows for more accurate financial planning and forecasting, which is essential for maintaining solvency and supporting growth initiatives.

Customer satisfaction is another area positively impacted by real-time payment systems. The ability to provide instant payment options improves the overall customer experience, fostering trust and loyalty. A study by 'Olli [59]' indicates that consumers increasingly prefer businesses that offer flexible and immediate payment solutions. For SMEs, this can translate into a competitive advantage, attracting more customers and retaining existing ones through superior service offerings.

The adoption of real-time payment systems has been linked to business growth for SMEs. By improving operational efficiency, financial management, and customer satisfaction, RTPS create an environment conducive to scaling operations. According to Mills [52], SMEs utilizing real-time payments report higher revenue growth compared to those relying on traditional payment methods. The speed and reliability of RTPS facilitate quicker business transactions, enabling SMEs to capitalize on market opportunities more swiftly.

Despite the benefits, there are challenges associated with implementing real-time payment systems. The initial setup costs and integration with existing financial systems can be significant hurdles for SMEs. Additionally, concerns around cybersecurity and fraud prevention are paramount, as real-time transactions require robust security measures. Research by Bada and Nurse [9] emphasizes the need for SMEs to invest in secure payment platforms and educate employees.

2.6. Theoretical Framework

2.6.1. Transactional Cost Theory

According to the Transactional Cost Theory emerged by Ronald Coase and followed by Oliver Williamson, firms are the institutions that are created and make the decisions where and how they need to transact to minimize transaction costs [90]. Transaction costs consist of costs of seeking information as well as costs of negotiating, supervising and policing contracts [91]. These costs can be costly for SMEs consequently becoming factors that hinders its operations and growth [26]. AI-powered RTP systems have the potential to significantly lower these transaction costs by eliminating the time that humans spend repeating some bothersome routine processes, offering real time data and thus increase the degree of openness in financial transactions [94]. Due to the optimization of payment processes, AI and RTP technologies save the time and resources necessary for payments' management which can be directed to the development of SMEs core competencies [69]. The decrease of the transaction costs can result in better management of the operations cost, management of cash flows and increase of competitiveness in the market [69]. Hence, this theory offers a sound premise for analyzing how new technologies can help reduce entry and operating risks in the markets especially in regard to SMEs that ordinarily do not possess vast resources.

2.6.2. Unified Theory of Technology Acceptance and Use (UTAUT)

The Unified Theory of Technology Acceptance and Use (UTAUT) model by Venkatesh and colleagues which offers a strong theoretical foundation for surveying the acceptance and usage of technological innovations at the individual and organisational levels (Venkatesh et al., 2003). UTAUT identifies four key constructs that influence technology acceptance and usage: performance expectancy, effort expectancy, social constructive influence and supporting conditions respectively (Venkatesh et al., 2003). Performance expectancy is the extent to which an individual thinks that the use of the technology will benefit him in terms of job performance [92]. In the case of the SMEs this is equivalent to the promise that new AI integrated RTP systems will improve the operations of the businesses, their reliability, and customers' satisfaction. Effort expectancy is related to the perceived 'completeness' of the particular technology [92. 39]. The general perception of SME owners and employees on the ease of deployment and usage of the AI-powered RTP systems is fundamental to their facilitation [92].

Perceived social norm relates to how much the individual feels that transitional figures including the peers, customers, competitors, and the society in general expects him/her to engage in usage of the new technology [92, 89]. The last component deals with the facilitating conditions that enhances the usage of the particular technology by having the necessary organizational and technical support systems in place (Venkatesh et al., 2003 & Hu, 2020). Thus, UTAUT enables to identify the factors that can either encourage or hinder the adoption of AI and RTP technologies in the SME.

Generally, these theories are indispensable for the elaboration of the measures conducive to the steady increase in the utilisation of these technologies by SMEs and improving the effectiveness of their use for the purpose of increasing business performance. The use of Transactional Cost Theory and UTAUT proves the purpose of this study to investigate not only the economic benefits of adopting RTP system with Artificial Intelligence but also the behavioral and organisational factors that dictate the acceptance and utilisation of technology. The implications of AI and RTP technologies for SMEs are complex and include multiple aspects, and the present work suggests this theoretical model as an integrative and cohesive foundation for future research in this field as well as for designing and implementing related practical solutions.

2.7. Empirical Review

The myriads of inconceivable duties performed by AI has enhanced the operations of many small enterprises, even challenging the overpowering dominance of mega-corporations and organizations. It means that developing and prospering enterprises may effectively employ AI at any time, in every place, and any culture. Advancements in AI, such as chatbots, smart assistants, Snapchat filters, wearables, and many other applications, have demonstrated the leading approach for businesses to launch and promote their goods to customers with less stress [68]. It has evolved into a practical and trustworthy application for small and medium-sized organizations to survive and prosper in their daily commercial activities. AI for small and medium-sized organizations is useful in the sense that it allows companies to employ fewer staff while also ensuring efficiency in running their business online. It also enables small and medium-sized organization to boost their productivity through increased sales and client demand [79]. AI offers small and medium-sized organizations a feeling of originality and creativity in content imagery [84], as well as income generation [68] via digital marketing to customers [52]. AI also allows small and medium-sized organizations to develop and analyze client response rates [52] as well as their attractiveness to the company site. Following global inflation, pandemics, and natural calamities, small and medium-sized organizations have frequently turned to AI as a last option

to ensure that they can present their products and services to customers. The conventional usage of brick-and-mortar businesses is slowly being replaced by the online use of AI.

Small and Medium-sized Businesses have grown throughout the years, which has benefited the country's economy. In California, the number of registered small enterprises has reached 4.2 million [56], accounting for 33.2 million registered firms in the United States [56]. While the number of small companies is thought to be increasing, this has resulted in more contact between company owners and consumers through the use of generative-powered AI apps. According to Moore [53], 41 percent of US customers prefer to process products and services through chat assistance. According to Ariella [5], 255.59 million Americans shopped online in 2020. This number of participants reported that company owners and customers communicated several times via AI-powered generative online communication. Although the use of AI may be difficult to understand among SMBs in California, various reports of e-commerce shopping in the United States and the higher percentage of businesses found in the state indicate that SMBs have been influenced more in relating with customers who purchase or order products online or through an internet channel. AI's influence on SMBs may be seen through the procedures outlined below. AI has influenced and altered the way SMBs run and conduct their company in ways other than physical product display or shop rental. AI technology innovation has pushed SMBs to put their services online and digitalize how payments are made for every customer transaction. Consumers' increased need to engage with SMBs via an online medium has left company owners with little choice but to integrate new AI technologies into their operations for growth, productivity, and development. As a result, it was simple for customers to relate to and engage with businesses that had already opened their operations online and make purchases, according to Ariella [9], who forecasts that more than 255 million people in the United States will shop online in 2020. And the number has increased in future years. In this situation, many small and medium-sized businesses have been encouraged to adopt and collaborate with the new AI technology. Yaqub [84] discovered that in the United States, around 30.57 million businesses used social media to sell their products and communicate with customers. Main [44] stated that small enterprises in the United States have boosted the total number of jobs over time.

Stankic et al. [73] discuss some of the issues that payment systems confront in the current era of technological innovation and digitization. Current payment and financial system developments include the increase of payment choices, the need to prioritize data infrastructure and security, and the introduction of machine learning and artificial intelligence technology. This research study emphasizes that banks and regulatory authorities are pushing payment migration to the digital arena, which has the potential to reduce transaction costs for banks and, as a result, operating expenses. According to the survey results, changes caused by ICT growth and digital transformations in the business sector need the adaptation of payment systems to the demands of the "digital age". Olli [58] examined the influence of real-time payments on companies and discovered that real-time payments provide a variety of use cases and benefits for company use. According to the study, the present benefits of RTP are more prevalent in small and medium-sized businesses. RTP improves the transparency of organizations' cash positions and enhances working capital. Furthermore, RTP can boost customer service and happiness while transforming the economy into a more organized shape. RTP can also improve supply chains by enabling speedier payment processing and the use of Just-In-Time payment methods. For many businesses, it makes little difference whether cash are sent in real time or not. RTP is an individual payment, thus processing them for certain firms may be more difficult than processing several payments in the collection. RTPs are more costly to send than traditional batch payments. If a corporation does not use the most recent payment standards, implementation expenses may be considerable. The study also discovered that, while the rich and structured data in payments helps process payments automatically and safely, payment frauds may occur with RTP monitoring since payments cannot be halted after they have been initiated. Although the use of RTP is projected to grow, it is believed that not all payments will be processed in real time in the future. Prabhakar [64] investigates the potential prospects that RTP provides banks and financial institutions across a wide range of consumer and corporate use cases, particularly business-to-business (B2B) transactions. It also looks at the particular hurdles that the US market has for RTP adoption when compared to comparable programs in other regions. Finally, the study provides a series of practical advice for financial organizations considering an RTP journey. According to Listwan and Kruis [40], the United States has been playing 'catch-up' in terms of building rapid payment systems, but the wheels are starting to revolve quickly. The recent implementation of same-day automated clearing house (ACH) payments was a first step, but other federal government-led projects are now ongoing, laying the groundwork for even quicker and more efficient real-time electronic payment capabilities. For example, the Federal Reserve's Payment Task Force has established both goals and effectiveness criteria for new real-time payment systems. At the same time, attempts in the United States to create real-time payments are affected by regulatory criteria established by the Consumer Financial Protection Bureau. The Clearing House's real-time payments (RTP) infrastructure is set to launch with consumer bill payments and business-to-business payments pilots in the first half of 2017, in one of the most anticipated developments. The potential benefits of these advancements for commercial users include enhanced supply chain and financial management.

Even with the encouraging developments in AI and RTP systems, there is still a large knowledge vacuum about the precise effects of these technologies on the performance and sustainability of small and medium-sized businesses (SMEs) in the US. There is no actual data on how AI and RTP directly affect the survival rates and long-term growth of SMEs, despite the literature's overall emphasis on the benefits of these technologies for enhancing operational efficiency, risk management, and cash flow. Furthermore, there is a lack of thorough discussion of the many difficulties that SMEs may encounter, including data security, implementation costs, and cyber-attack risk. The complex consequences of AI and RTP adoption on SMEs across different sectors, geographical areas, and company growth phases require more investigation. This knowledge is essential for creating focused strategies and regulations that facilitate the successful integration of new technologies, guaranteeing that SMEs can take full use of their potential while reducing related risks.

3. Material and methods

3.1. Research Design

The research methodology for this study was developed and operationalized using Mark Saunders "Research Onion" instrument to enhance the understanding of the implications of Real Time Payments System facilitated by AI capabilities in SMEs in the United States. Interpretivist research philosophy is adopted for this study. The choice of the research philosophy enabled the description of the patterned experiences and contextual interpretations of SMEs in AI technology adoption. The interpretivist research philosophy is suitable for collecting contextual interpretations and meant experiences of SMEs regarding the utilization of AI technology based on this research philosophy [63]. The abductive approach was used when analyzing secondary data, which is a combination of inductive and deductive approaches. This approach helps one to understand relationships or patterns of different factors by observing a given phenomenon [56]. This method would help to ensure that the effects of Ai on Real Time Payments System are captured construed in a supple manner, using relevant data sources.

3.2. Research Strategy

The research design is sequential explanatory, whereby the quantitative phase is conducted then followed by the qualitative phase. This strategy makes it possible to use the quantitative results to guide the qualitative part, focusing more closely on certain aspects and themes that research results reveal. The strategy comprises three main phases: a study of the existing literature to focus on emerging trends, threats, and opportunities of AI and RTP technologies in SMEs; collection of secondary quantitative data from credible sources like Statista and the European Union of Statistics concerning the effects of AI acceptance on SMEs in the US.

3.3. Data Collection

The technique used in coming up with the data for this study has many crucial stages to ensure accuracy, relevance and sufficiency. In order to ensure a comprehensive analysis, the secondary data of this study was collected from various sources. This involved assessing existing literature from scholarly journals, industry reports, white papers and other studies from reliable sources like Statista, McKinsey & Company, Deloitte and the European Union of Statistics amongst others to ensure a strong data set with data collected before and after the COVID-19 outbreak. Thus, by using the materials of various topics and areas, this work can provide a broad picture of the discussed material and define the main trends, issues, and prospects for the application of artificial intelligence in FinTech breakthroughs. More so, the content was structured based on certain themes including AI payments, especially with regard to supply chains to allow for the focused examination of the problem.

3.4. Data Analysis

The method used in this study was secondary data analysis that involved the use of statistical tools used in the interpretation of data Graphical presentation and statistical analysis. Graphic displays are used to show the trend and patterns of the data as opposed to numbers because they bring out a clear picture of the data and normally pass on important information not given by numbers. In addition, bar charts and line graphs were applied by this study to show data trend in the sampled periods [84]. Moreover, the quantitative techniques used to organize and present the characteristics of the variables within the context of the study were the descriptive statistics. For the level of consistency in the data set, mean, Standard Deviation and Jaque Berra statistics will be applied. In addition, the overall effect of using the AI technology in the performance of the US SMEs will be measured by using a simple linear regression test.

3.5. Ethical Considerations

In this study, the process of data collection for this study will respect ethical issues pertinent to the research in order to adhere to the ethical benchmarks of the source of secondary data for the study. This was achieved in the following way; The right data sources were provided and the data was graphically depicted well. Proper adherence was also observed in agreement governing the use of data such as citations and appropriate referencing.

4. Findings and analysis

In this chapter, the data collected through various research methods is presented and analyzed. The analysis is aimed at addressing the research questions outlined in Chapter 1 and testing the hypotheses developed. The data presentation is carried out in a systematic manner, using tables, charts, and graphs to represent the findings. The chapter also includes a discussion of the findings in relation to the existing literature reviewed in Chapter 2.

4.1. Digital Payments in the US
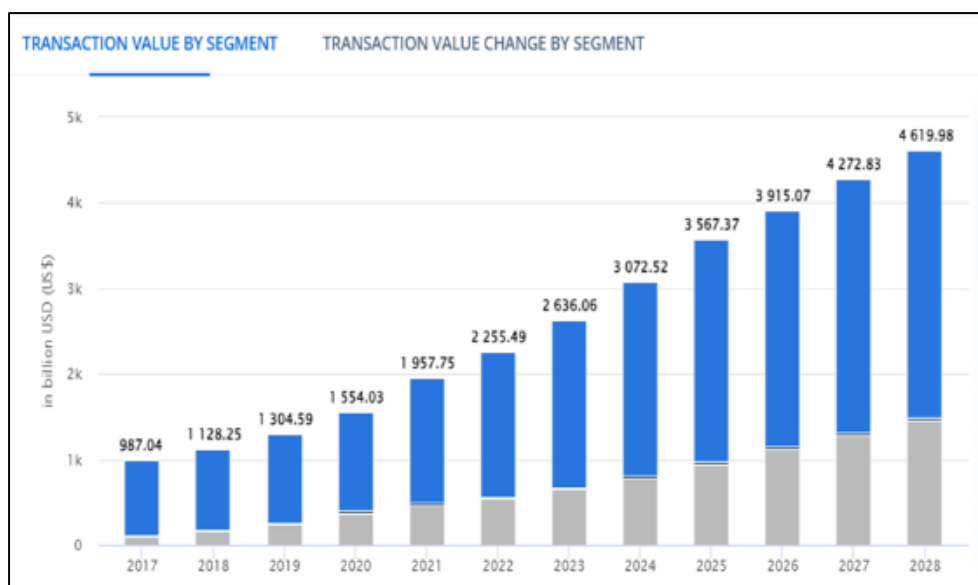
Source: Statista (2024a). Digital Payments - United States. Available at: https://www.statista.com/outlook/dmo/fintech/digital-payments/united-states#transaction-value

Figure 1 Diagrammatic Representation of Digital Payments in the United States

Figure one above based on the rate of digital payments in the US indicates a fast-growing market of digital payments in the United States, with the total value of transactions in this sector expected reaching USD 3,073 billion in 2024 (Statista, 2024). As far as the data statistics in Statista is concerned, this market is further projected to record an annual growth rate (CAGR) of 10.73% from the year 2024 to 2028 to a projected total of USD 4,620 billion by 2028. Of all the segments within the digital payments market, Digital Commerce becomes the biggest segment with an estimated transaction value of USD 2,255 billion in 2024. This data suggests a significant increase in use of digital payments in the last five years in the US due to factors such as growth in online shopping, use of virtual and contactless cards, Fintech among others [48]. The worldwide analysis shows that the Chinese market is on top of the list with an electronic transaction value of USD 3,744.00 billion in 2024 [79]. This places the US among the frontline countries in the management of digital payments while at the same time having a smaller market share than China.

Moving forward, recent empirical studies conducted after 2020 indicates that the adoption of AI technologies by U.S. SMEs significantly impacts their access to payment rates and overall financial performance. One of these studies indicates that AI enhances data analysis and operational efficiency, allowing SMEs to manage big data effectively and implement real-time decision-making processes, which can lead to improved service delivery and customer satisfaction [23]. This operational improvement is crucial for SMEs, as it facilitates better customer engagement and faster transaction processing, ultimately enhancing payment access [59]. Furthermore, AI's role as a General-Purpose Technology (GPT) positively influences firm value and cost structures, indicating that SMEs adopting AI can expect better financial outcomes [34]. However, while the benefits of AI adoption are evident, the research highlights the need for SMEs to navigate challenges related to technology integration and resource allocation, which can affect their ability

to fully leverage these advantages [96]. Overall, AI adoption appears to be a critical factor in improving payment access and financial performance for U.S. SMEs.

4.2. The Impact of AI Technology on the Performance of US SMEs
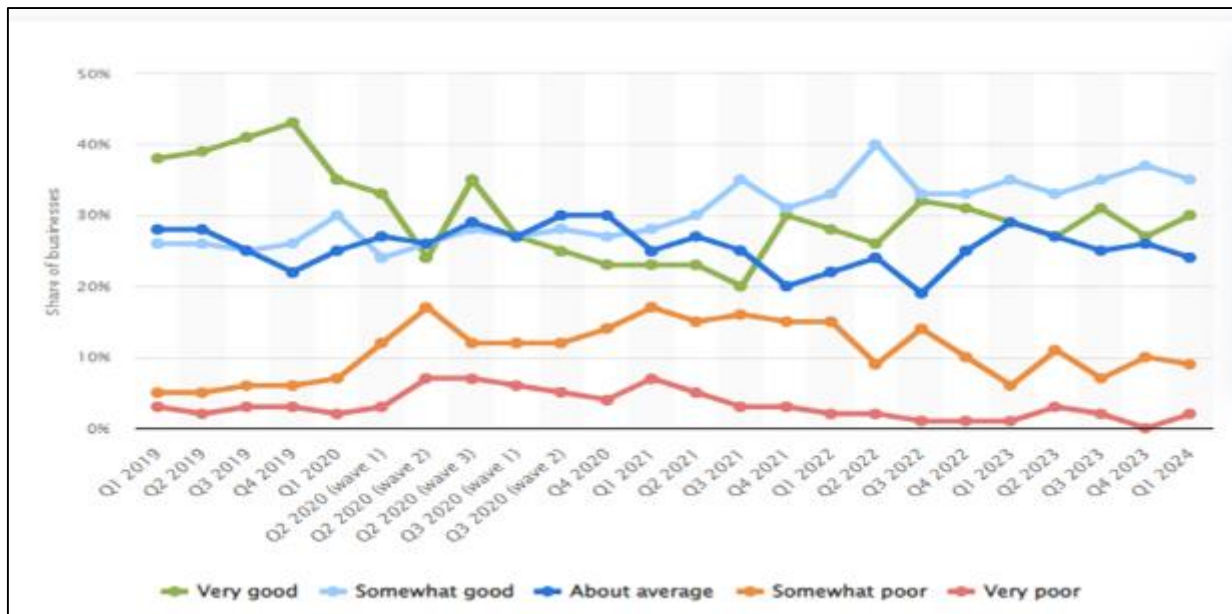
Source: Statista (2024b). U.S. Small Business Index: overall health of business Q1 2019 - Q1 2024. Statista Research Department. Available at: https://www.statista.com/statistics/1372765/small-buisness-index-us-health/

Figure 2 Small Business Index in the United States from the first quarter of 2019 to the first quarter of 2024

The figure 2 above revealed the US SMEs quarterly overall health of business spanning through 2019 to 2024. The graphical trend appears to be unstable over the sampled periods with 65% of the sampled respondents indicates that their business was in a favourable condition while 24 percent of participants indicated that the state of their business's health was average. In 2019, the proportion of small enterprises in excellent condition reached its highest point at 43 percent. As a result of the COVID-19 pandemic, the percentage decreased to 25% by the end of 2020.

Furthermore, secondary data sources withing the time frame of 2020 to 2024 revealed that the impact of AI technology on the performance of US SMEs is multifaceted. It revealed themes related to improved data analysis and real-time decision-making; customer experience and sales performance; enhancing absorptive capacity and customer agility; marketing communications performance; improving processes, operations, and competitive advantages; HR management, automating processes, reducing risks, and cutting costs; enhances decision-making, employee management, inventory control, customer relations, and cybersecurity with the significant potential for enhancing operational efficiency and market competitiveness emerging as the major theme.

One of these studies shows that AI systems facilitate improved data analysis and real-time decision-making, which are crucial for managing big data and reducing operational complexities in SMEs [24]. Furthermore, AI-driven personalized marketing automation has been shown to enhance customer experience and sales performance, leading to increased engagement and retention [33]. Empirical studies indicates that AI assimilation positively influences firm performance by enhancing absorptive capacity and customer agility, which are critical for adapting to market changes [78]. Also, AI adoption correlates with improved firm value and cost structures, underscoring its role as a transformative technology in the competitive landscape of SMEs [35].

Furthermore, AI technology optimizes marketing activities in US SMEs, enhancing efficiency on social media through content creation, post scheduling, and campaign analysis, ultimately improving marketing communications performance [33]. Moreso, empirical studies shows that AI technology transforms entrepreneurship by enhancing decision-making, fostering innovation, and shaping business outcomes for US SMEs, as explored in the research on AI's impact on business performance.

According to AI technologies, like machine translation and chatbots, enhance US SMEs' performance by improving processes, operations, and competitive advantages, as shown in the study on AI's effects on company performance carried out by Domini, et al [16]. Similarly, AI technology significantly enhances US SMEs' performance by improving processes, practices, and overall organizational efficiency, enabling them to navigate a competitive environment [48]. In the same manner, AI significantly enhances operational efficiencies, customer engagement, and product innovation in US SMEs post-pandemic. Barriers include expertise gaps and funding constraints, with recommendations for sustainable growth and innovation [95]. Additionally, AI enhances US SMEs by improving HR management, automating processes, reducing risks, and cutting costs. It boosts efficiency, aiding in competitiveness and growth in the evolving market environment (Liu, 2024). However, these researches also highlight the need for ongoing innovation and ethical considerations in AI implementation to fully realize these benefits. Overall, AI presents substantial opportunities for US SMEs to enhance their performance and sustainability.

4.3. The Impact of AI Technology on US SMEs Risk Management

4.3.1. Themes Classification based on the Impact of AI Technology on US SMEs Risk Management

Empirical studies within the time frame of 2020 to 2024 revealed that the integration of artificial intelligence (AI) technology significantly enhances risk management for small and medium-sized enterprises (SMEs) in the US. These studies show themes related to identify potential risks and make informed decisions; respond to market fluctuations and uncertainties; improving predictive accuracy, fraud detection, and compliance processes; credit risk management, fraud detection, data quality monitoring, and operational resilience with informed decision making, operational efficiency and response to market fluctuations emerging as the major themes.

The integration of artificial intelligence (AI) technology significantly enhances risk management for small and medium-sized enterprises (SMEs) in the U.S. AI facilitates improved data analysis, enabling SMEs to identify potential risks and make informed decisions through predictive modeling and real-time insights [43, 24]. This capability is crucial as SMEs often lack specialized human resources and face unique operational challenges [43]. Moreover, AI enhances supply chain agility by allowing SMEs to dynamically respond to market fluctuations and uncertainties, thereby improving their risk management strategies [82]. Similarly, AI technology enhances US SMEs risk management by analyzing vast data, adapting to market changes, providing real-time insights, and proactive risk mitigation, thus improving decision-making and financial stability [86]. Also, AI enhances US SMEs risk management by improving market and credit risk management, fraud detection, data quality monitoring, and operational resilience. It revolutionizes financial risk management strategies for SMEs [93]. Moreso, AI technology significantly enhances risk management for US SMEs by improving predictive accuracy, fraud detection, and compliance processes. Challenges include regulatory adaptation and ethical considerations in implementation [16]. Furthermore, AI offers US SMEs opportunities to automate processes and enhance risk management.

AI and machine learning positively impact risk management in various sectors, including credit risk, market risk, operational risk, and compliance. However, challenges like data management and skill shortages exist [7]. Furthermore, AI applications in financial risk management enhance accuracy, efficiency, and cost-effectiveness for US SMEs. These technologies offer a new perspective on risk assessment and management, aiding in competitiveness [18]. Moving forward, AI positively impacts US SMEs risk management by enhancing efficiency, monitoring capabilities, and reducing human error. It offers opportunities for better decision-making and operational optimization in business management [67]. Also, the impacts of AI on US SMEs' risk management include revolutionizing processes and decision-making, while also raising concerns about ethics, privacy, and accountability, necessitating clear regulatory frameworks (Naeem, 2023). Additionally, AI-driven financial risk management systems enhance predictive capabilities and operational efficiency for US SMEs. They reduce loan defaults, improve portfolio quality, and ensure regulatory compliance, enhancing overall resilience [72]. The systematic review of literature conducted by Sotamaa et al. [73] indicates that digital technologies, including AI, are essential for SMEs to navigate disruptions and enhance business continuity. However, while U.S. banks exhibit advanced AI adoption in risk management, the overall implementation in SMEs may still be developing, highlighting a need for further investment in technology and training [55]. Thus, AI presents both opportunities and challenges for U.S. SMEs in optimizing their risk management practices.

5. Summary, conclusion, recommendations, contribution to knowledge, limitations of the study and the area for further studies

5.1. Summary

This study aims to evaluate the impact of ai on real time payment (RTP) for small and medium scale enterprises performance in United States of America and specifically seeks to evaluate the impact of AI technologies adopted by US SMEs on access of payment rate, examine the impact of AI technology on the performance of US SMEs and assess the impact of AI technology on US SMEs risk management using data from various sources like Statista, publications and current academic journals among others so as to sure that the data collected was wide and covered the recent occurrences as AI is becoming widespread.

Findings from the analyzed data shows that based the rate of digital payments transactions in the US is growing on a fast rate which is becoming more prominent after the covid-19 pandemic period. Also, recent empirical studies conducted after 2020 period indicates that the adoption of AI technologies by U.S. SMEs significantly impacts their access to payment rates and overall financial performance thereby answering the first research question of this study. Mores, findings based on the impact of AI on the performance of SMEs in the United State shows appears to be unstable with the sampled periods of 2019 to 2024 with larger percentage of the sampled respondents in 2024 indicating that their business was in a favourable condition.

Findings from various secondary data sources withing the time frame of 2020 to 2024 revealed that the impact of AI technology on the performance of US SMEs is multifaceted and revealed themes related to improved data analysis and real-time decision-making; customer experience and sales performance; enhancing absorptive capacity and customer agility; marketing communications performance; improving processes, operations, and competitive advantages; HR management, automating processes, reducing risks, and cutting costs; enhances decision-making, employee management, inventory control, customer relations, and cybersecurity with the significant potential for enhancing operational efficiency and market competitiveness emerging as the major theme.

On the final note, the findings on the impact of AI on risk management in the US within the time frame of 2020 to 2024 revealed that the integration of artificial intelligence (AI) technology significantly enhances risk management for small and medium-sized enterprises (SMEs) in the US. These studies show themes related to identify potential risks and make informed decisions; respond to market fluctuations and uncertainties; improving predictive accuracy, fraud detection, and compliance processes; credit risk management, fraud detection, data quality monitoring, and operational resilience with informed decision making, operational efficiency and response to market fluctuations emerging as the major themes.

5.2. Conclusion

The financial system of the United States carries out a vast number of transactions on a daily basis, enabling the exchange of goods and services using various methods such as checks, drafts, and electronic money transfers. SMEs which contribute significantly to community development by creating employment opportunities, experience higher rates of failure compared to larger companies. Due to their significant economic influence and heightened risk of collapse, it is imperative to explore strategies to guarantee their continuity.

Findings from this study confirms that the use of AI technology by US SMEs is on the increasing rate and that AI technology has significantly impacted SMEs performance particularly in terms of enhancing operational efficiency and market competitiveness. Also, the findings from this study shows that AI technology significantly helps in SMEs proper risk management particularly in the areas of informed decision making, operational efficiency and response to market fluctuations. The findings from this study is consistent with that of Schroer [69]; Ariella [5] and Yaqub [87] whose studies shows that the adoption on AI for payment transactions is on the increasing rate and that SMEs productivity and risk management is on good positioning due to the adoption of AI in the business management process.

5.3. Recommendations

Base on the study's findings, the following recommendations are provided;

- SMEs in US should adopt AI keep adopting the use of AI technology to process transitions as it will unambiguously improve their services delivery and facilitate smooth and fast transactions.

- SMEs in the US should adopt AI technology for decision making and market forecast so as to enhance their operational efficiency and market competitiveness
- SMEs should adopt the use of AI technology in fraud detection, compliance processes, credit risk management, data quality monitoring and operational resilience so as to ensure proper and efficient risk management.

The government should support and encourage the us of AI technology by SMEs in US through various means such as business grants so as to eliminate the financial barriers that could be faced by SMEs in adopting AI technology for payment system and business decision making.

5.4. Contribution to Knowledge

This study contributes to the existing studies on the impact of AI on payment system, organizational performance and organizational risk management as the adoption of AI technology became prominent due to the advent of Covid-19 pandemic and as such, creating the need to evaluate this area of research furthermore. Also, organizational risk management have become prominent among SMEs so as to make informed decision and plan against market fluctuations which requires large data base so as to make an accurate forecast and ensure proper stock management and eliminate wastage and allocate resources efficiently and effectively. Therefore, the results of this study have practical consequences for small and medium-sized enterprise (SME) owners and managers, providing valuable insights for making strategic decisions and enhancing the development of more efficient strategies for adopting technology. In addition, governments should utilise the knowledge acquired from this research to create effective policies, including as monetary incentives and educational resources, to encourage the implementation of AI and RTP technologies among small and medium-sized enterprises (SMEs).

5.5. Limitation and Suggestions for future Studies

Despite the significance of this study, the limitations of the study must be acknowledged. The limitations of this study are discussed below;

- **Focus:** This study only focused on how the Adoption of AI technology affected SMEs in the US. Further research can expand the scope to be more specific to the nature of organizations or sectors as different organizations and sectors has its own preferences based on the use of Digital technology.
- **Scope:** The time frame of this research ranges from 2017 to 2024 due to data availability and time constraint. Future studies could seek to expand the scope by comparing the pre-pandemic and post pandemic periods on how AI adoption affected SMEs.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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