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The Mediating Role of Trust in the Relationship Between Perceived Usefulness, Perceived Ease of Use, and QR Payment Adoption Among Retail SMEs in Selangor, Malaysia

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ABSTRACT

The adoption of QR payment systems has shown significant progress in enhancing financial transactions, offering opportunities to improve efficiency and expand market reach. This study investigates the factors influencing QR payment adoption among small and medium enterprises (SMEs) in Selangor, Malaysia, emphasizing the mediating role of trust in the Technology Acceptance Model (TAM). Specifically, the research examines the impact of Perceived Usefulness (PU) and Perceived Ease of Use (PEoU) on QR Payment Adoption (QPA), with Trust (CT) acting as a mediator. A structured online questionnaire targeting retail SMEs in Selangor was used to collect data, employing a cross-sectional research design.

The analysis was conducted using SmartPLS software to assess the relationships between independent, dependent, and mediating variables. The findings reveal that both Perceived Usefulness and Perceived Ease of Use significantly influence QR Payment Adoption. Moreover, Trust was found to be a crucial mediator, enhancing the perceived security and reliability of QR payment systems. The study provides valuable insights for policymakers, banking institutions, and digital payment service developers to formulate strategies aimed at fostering the adoption of QR payment systems among SMEs. Additionally, the research contributes to the academic discourse by integrating Trust as a critical mediator within the TAM framework, addressing a significant research gap in digital payment adoption literature.

This study also highlights the importance of building consumer trust to accelerate the adoption of QR payments, especially among resource-limited SMEs in Selangor. The findings underscore the need for enhanced training, awareness programs, and reliable digital infrastructure to support a seamless transition toward cashless payment systems. Further research could explore the longitudinal impact of trust and extend the scope beyond Selangor to encompass other states in Malaysia.

Keywords: QR Payment Systems, Technology Acceptance Model (TAM), SMEs, Digital Payment Adoption, Trust Mediation, Perceived Usefulness, Perceived Ease of Use, Intention to Use, Selangor, Malaysia, Structural Equation Modeling (SEM).

CHAPTER 1
INTRODUCTION

1.1 Research Background

The rate at which digital advancements occur not only impacts payment and transaction methods for businesses and business operations but also affects how businesses interact with consumers. For example, one of the latest developments in payment systems is QR payment technology, which is trending across various fields, especially retail operations. Such developments are trending worldwide as digital improvements make payments faster and easier, more accessible to new demographics, and improve customer service.In Malaysia, however, the trend to transition to digital payment is slowly occurring as well, with governmental policy developments paving the way for a cashless society and technological integration across fields. SMEs are the heart of the Malaysian economy. Approximately 97% of registered companies belong to the Malaysian SME classification and contribute nearly 38% of Malaysia's GDP. In Malaysia, SMEs play a paramount role in increasing its economic value, which contributes significantly to its GDP, exports, and employment. Accounting for around 97.2 per cent of enterprise organisations in Malaysia, including microenterprises and SMEs contribute to around 48 per cent of federal employment, 38.2 per cent of prevailing GDP, and 13.5 per cent of the overall exports of the nation (worldbank.org, 2022). Therefore, within the larger Malaysian SME ecosystem, the retail SME sector is vital for local job prospects, and it is typically where consumers first engage; retail sectors provide customer services. Thus, like any other competitive advancement, retail SMEs need continual operational innovations through technology.

Currently, the world is going through different digital transformations, and every day new technology is approaching. To ease the work process and give better satisfaction to the customers, people are working to develop new technologies so that the work process can be made easy to use not only for techies but also for non-techies. The online payment system is developing day by day, to make people experience hassle-free experiences in transferring money for various purposes such as shopping, bill payment, and so on. One innovative development that can offer support is the QR payment system—an inexpensive, secure, and simple payment solution that can network retailers for better payment acceptance, lower operational expenses, and ever-increasing consumer demands. Selangor's retail market—located in Malaysia's most populous and financially developing state—illustrates what QR payment integration could represent, along with the associated economic factors. As a developed commercial area, Selangor's retail SMEs work in a competitive, fast-paced environment where rapid penetration, digitization, and consumer trends evolve quickly over time. For instance, higher levels of e-commerce, e-wallets, and cashless payment options reflect a universal—and local—application where everyone looks for ease. Consequently, the relative prevalence of QR payment systems is high—it is available to anyone, has a low entry cost for SMEs, and is adaptable to small, medium, and large retail enterprises.

Yet, the requirement for QR payments for retail SMEs is a different approach. While retail mega-chains appear to have embraced digital payments almost overnight, many small retail shops either remain reluctant—having tested such systems in the past—or realize they will need them in the future to grow. The authors argue that this future need arises from existing problems (such as security issues) and a general reluctance to adopt digital payment methods. In addition, retail SMEs may have lower digital literacy or encounter more "sticker shock" when adopting an alternative payment solution. Therefore, the necessary enhancements depend on concerns in each industry to enable potential improvement.

A positivist approach in the literature shows that the Technology Acceptance Model is a critical theory to measure these variables influencing technological acceptance. The Technology Acceptance Model posits that perceived usefulness and perceived ease of use are essential attributes affecting an individual's willingness to adopt new technology. However, trust is a crucial attribute that moderates willingness or ease of acceptance of QR code payments. Since retail SMEs require secure payment options, and trust from consumers is extremely pertinent, trust-related issues become more pronounced in this context. In Malaysia, the Technology Acceptance Model is used to assess the adoption of various new technologies not only in the field of payment systems but also in e-learning platforms and mobile applications. The rise of e-wallet systems is so evident in Malaysia besides the use of QR code payment systems, these two systems are changing the preferences of the customers. This particular model allows for an increase the development of the positions of managing the business by increasing the scope of adopting technological advancement. This particular development allows to share an overall progress that allows us to maintain a suitable environment, which will be helpful to adopt any technology within the organization. The technology acceptance model secures the positions of changes in the organisation and this discussion carefully allows to secure the progress by increasing the positions adopting the changes within the organization or in different public sectors. Therefore, the Technology Acceptance Model—augmented by the dimension of trust—validates acceptance of the payment process during implementation within this specific industry.

As QR payment systems also require consumers to trust the transaction as much as the app, trust becomes increasingly important. For example, physical retailers face adoption obstacles due to data breaches, scams, chargebacks, and payment data integrity; thus, trust-related concerns exist. Payment processors, banking institutions, and government bodies must ensure that trust is part of the solution through regulatory oversight, informational campaigns, and consumer protection efforts that highlight the feasibility of QR systems. Problems can arise as many people are not so aware of the QR payment technology, maybe they are using it for the first time, or persons with less knowledge of technology are using it. So incorporating trust within them is very important to increase the usage of the technology. A single mistake in monitoring can lead to distrust, then it can be difficult to build trust again.

Thus, this research seeks to determine the factors that influence QR payment adoption by retail SMEs in Selangor, including trust as a mediating factor. Determining whether trust mediates the relationship between perceived usefulness and perceived ease of use can provide practical insights for governmental policymakers and developers of digital payment services, while enabling retail SMEs to optimize the benefits of these digital payment applications. Ultimately, establishing this relationship can lead to a broader understanding of the digital payment network and potential solutions for digital transformation in the retail industry, thereby improving sustainability and competitive advantage.

Furthermore, the authors observe that findings of QR payment implementation within one chosen company can extend well beyond it. The greater the percentage of companies that digitize payment processing, the greater the financial inclusion, supply chain efficiencies, and formalization of the retail economy. Less cash translates into fewer cash-related worries—such as cash control and transaction errors—contributing to effective revenue generation. In addition, the more enterprises work within the formal banking economy instead of relying on cash for daily transactions, the more likely Malaysia is to fulfill its vision of an innovative, digitalized future as outlined in the Digital Economy Master Plan.

The findings of this study will impact on all parties involved in efforts to enhance digital adoption among retail SMEs. First, policymakers will learn which attributes to emphasize when developing programs that

facilitate QR payment adoption. Second, banks and financial institutions can adjust financial offerings to fit retail SME needs. Third, technology developers can improve usability, reliability, and security to support sustained digital expansion. Ultimately, the capacity of QR payments to generate operational efficiencies, improve customer engagement, and stimulate socio-economic growth could transform the future of retail SMEs in Selangor. By examining trust as an adoption variable, this work not only addresses a crucial gap in existing research but also offers practical insights for advancing Malaysia's digital payment industry toward a more sustainable future.

1.2 Overview - QR Payment Systems

QR payments have become very significant in Malaysia and this new trend has changed the face of Malaysian transaction landscape as digital economies are growing globally. Appreciating the utility and ease of QR payments, Malaysia is a change driver in this development. The journey of QR payments in Malaysia began in the early 2010s and although the uptake rate was slow, it was a definitely a solution due to the requirement for effective, safe, and timely transaction methods. The early adopters were small businesses, technology enthusiasts and innovative financial organizations that set the stage for the massive adoption.

Since then, the QR payments in Malaysia have changed from a mere scanning codes to an entire ecosystem including users, merchants, and payment processors. Payment systems operators like Boost, GrabPay and Touch 'n Go eWallet have turned out to be the core players of Malaysia digital payment scene. Leading QR payment service providers such as D-service Sdn. Bhd and TNG Digital Sdn. Bhd have contributed significantly in influencing the market by introducing new ideas and service systems that made the operation more simple. These leading QR payment services are helping the people of Malaysia to become a cashless society. Not only the customers are getting benefits from it but the businesses are also taking advantage of the service, as it enables them to allow faster transactions in operations. The faster process of transactions helped the business to maintain the flow of cash very easily.

The QR payment platforms in Malaysia, mainly run by the financial institutions and fintech companies are web applications or mobile apps that enable users to produce and scan QR codes for a variety of services including merchant shop payments and bill payments. The QR payment market in Malaysia has grown in leaps and bounds, fueled by the high penetration of smartphones and changing consumer behaviour, often hastened by initiatives from the Malaysian government. After the pandemic of Covid-19, the preferences of customers have changed so much, that the need for contactless payments has risen so much from that time (Huterska et al., 2021). Not only the need for contactless payments but also the need for contactless deliveries has also risen. Nowadays, contactless payment has become a new trend, because it is very easy to process and less hassle-free.

Many people who are aged or some of the people are not aware of the new technologies very profoundly, they prefer to use the traditional way of transaction. For them traditional method of transaction is the best way to avoid the type of problems that may arise because of low connection in the internet. The QR code service is an internet-based technology so without the use of the internet, it is impossible to process the transaction. So, that is why, for some people, traditional ways of transactions are the best ways to transfer money. QR payments have disrupted the traditional way of payments which have been trying to challenge the traditional card payments model with the card still being preferred for the top up services. The regulating bodies for the QR payments are the likes of RePP-oriented regulatory body that ensures that the consumers are protected, and the interoperability and user experience are guaranteed by the standards and regulations. The low setup costs of QR payments, which are due to the high number of smartphone

users, are usually passed on to the consumer, providing great benefits to and entry barriers for first-time users.

A few years after, QR payments not only became a revolution in the financial transactions sector but also led to shifts in all the social and socio-economic and technological domains. The early stages of QR payments in Malaysia were fast-paced technical adjustments to make it more accessible and attractive to the masses. Most of those changes, therefore, significantly affect the behavior of the consumers and innovations in operations of businesses. The critical technological improvements and innovations, among which are the improvements in technological infrastructure, have made QR payments, real-time processing, two-way encryption, and reduced transaction fees a new standard. Second, the fast integration of QR payment into loyalty rewards and financial management systems. As a result, consumers became more powerful and had reasons to use QR payments and the entire payment ecosystem became well integrated with other digital services. Besides, this modification also influenced consumers who do not have to carry cash in many situations or operations. Since the procedure is safe and quick, the entire population had switched their method of cash transactions that was majorly in urban centers and high-end smartphone use. However, it also occurred in the rural locations, where the inhabitants started to communicate more with mobile devices, due to connectivity and financial literacy programs. In any case, this scenario has also affected business activities, however, the overall impact has been more positive. It has increased the consumer base who uses the digital transaction because it is more economical for SMEs when compared with the electronic systems. It has also simplified the payment settlements, making settlements faster and better cash flow.

In addition, QR payments have helped in formalizing the informal economy in Malaysia. Before, vendors and small service providers that were being paid in cash only were integrated into the formal financial tracking of the system. Without doubt, this attribute helps in making the traffic more comprehensive and the financial tracking more effective. Government measures and policies The Malaysian government also participated in the support of QR payments. For instance, when the central bank standardized all the different platforms and their QR payment systems, it created a kind of connection and faith amongst the people that this mode of payment was trustworthy. The other significant effort was the choice to fund to opportunity to migrate to innovations for both citizens and companies, which facilitated the path of QR payments transition. Prospectives The prospects of the Malaysian QR payment market are also daunting, the market will continue to flourish under the digital dominion of the state combined with the advancing of artificial intelligence and machine learning technologies. The processes will be personalized too and most importantly, safe because of the latter technologies as well. The latter is able to forecast user's decision making and fraud at the same time. Further, a sector where QR payments integration is very easy is the public sector. The industry will gain a lot from significant changes of the payment transactions becoming faster with the service. Arks are also more efficient and faster. The challenges being passed through, the threat that remains is the security issue, the most vital being data privacy and fraud. Industry's security endeavor and public education on privacy should go on. In addition, for the country to move forward together as one, it should ensure such technology is accessed equitably by all users to avoid the digital divide.

Technology is continuously developing and enhancing by researching the drawbacks of the previous versions. To overcome the drawbacks of the previous technology, many companies are working to bring innovation to their work. Innovation is very important in the context of attracting and retaining customers because, in the current era, only innovation can make a company gain profit in the market. Innovation in

technology can make a company gain a big share of the market (Farida & Setiawan, 2022). Technological developments, market share, and coverage in various segments will determine the future of QR payments in Malaysia. Most QR systems are cost-effective and efficient, and hence, improved QR systems could be the preferred method of payment in the near future. The QR code payment services are very effective for small businesses, the transaction fee in these services sometimes requires no fees or sometimes lower fees for transactions. So for small businesses, this service is very cost-effective and they can also get a lot of benefits from it. In general, QR payments in Malaysia are known for their speed, cost savings and ability to promote high technology innovations in the payment system sector.

1.3 Research Gaps

This study seeks to add to the existing knowledge base by exploring trust as a mediator in QR payment adoption among SMEs in Selangor, Malaysia. Though many studies have focused on different factors that impact the adoption of mobile payment technologies, there is still very little research on the mediating role of trust with regard to the adoption of QR payment specifically among the SMEs in Malaysia (Chong et al., 2021; Lee et al., 2019). To bridge this gap, this research aims to concentrate on peculiar trust dynamics in the SME sector and its influence on the relationship between such key elements as perceived usefulness, perceived value, and QR payment adoption. Trust plays an important part in influencing customers and businesses to adopt the technology of QR code payment systems. Trust influences the brand value of a company, as this is one of the major factors in the dealings of the business.

Nevertheless, the constraints of this research should be noted. Firstly, because of time and financial limitations, the sample size is limited to 200 respondents. Even though this sample size complies with the minimum requirement for PLS-SEM analysis (Hair et al., 2017), a bigger sample could possibly produce a more solid response and improve the generalizability of the results. Further studies may also consider extending the coverage of the sample size to include SMEs from different regions in Malaysia. A bigger sample size can be able to produce accurate results, and it can be more influential than the smaller sample size. It also reduces the chances of biases in the data and enables the researcher to publish its study more confidently. A focus on the SMEs must be given to allow the other researchers to build more profound results about the study in Malaysia. Not only the SMEs but a focus on the local people must be given to elaborate the scope of the study for gaining new results and develop an area for more innovative research in the future.

Secondly, this research focuses on the geographical area of Selangor, Malaysia. Although Selangor is a significant economic hub in the country, hosting a high number of SMEs (Department of Statistics Malaysia, 2020), the results may not be applicable to other states or localities within the country. Some of the places in Malaysia may not be as developed as Selangor, so this is one of the gaps of the study that can restrict the result of the study and create a conflict. SMEs in various regions may present their own unique challenges and have characteristics that might affect their acceptance of QR payment technology. Accordingly, future studies could investigate trust as a mediating factor of QR payment adoption among SMEs in other states or area to have a better understanding of the phenomenon.

Also, this research centers on one of the mobile payment approaches, QR payment, precisely. QR payment has become popular among SMEs in Malaysia (Bank Negara Malaysia, 2021), however; there are other mobile payment technologies such as Near Field Communication (NFC) and mobile wallets. In the future, further studies could explore the trust factor of these alternate mobile payment technologies, to provide a clearer picture of the mobile payment environment in Malaysia. QR code payment system is not the only service that is running in Malaysia, so to develop more understanding of the latest technologies in payment

systems. The scope of research on the other payment systems still persists and can help to build inspiration for other researchers to invent more advanced technologies to help people reduce their time to help them reduce their workload. Expanding the scope of the research can result in developing more innovative technology other than the QR code payment system. It can help other researchers to know the preferences of the Malaysian people in using technology for payment (Alam et al., 2021).

Finally, this study is based on a cross-sectional design that collects data at one point in time. The drawback of this method is that it deals only with the relationships between variables and does not provide the opportunity to consider the causal relationships or the long-term influence of trust on the adoption of QR payment. Longitudinal design could be implemented in the future studies to study the process of trust evolution and its effect on the QR payment adoption in time, which would give the insights into the dynamic nature of trust in the context of technology adoption.

Notwithstanding these drawbacks, this research adds to the literature by presenting empirical evidence on the mediating function of trust in QR payment adoption by SMEs in Selangor, Malaysia. These research outcomes can become a reference for further studies and recommendations for practical implications for small and medium enterprises, policy makers, and providers of mobile payment services in the field of QR payment technology adoption. The continuous development of technology is also pushing the government to reform its policies in order to build a more secure payment system for the people in Malaysia. These policies are very important to foster the culture of secure payment systems, as without a secure environment of the payment system, it is very difficult to build trust for this digital payment system. The impact of strong policies can help to build trust among the people and can result in increasing the use of QR payment services in Malaysia. Not only the country of Malaysia can get benefit from the expansion of the scope of research but other countries can benefit from it and then it can lead to an intense technological transformation for the advantage of people all around the world.

1.4 Problem Statement

The adoption of QR payment systems by Small and Medium-sized Enterprises (SMEs) in Malaysia, particularly in the state of Selangor, remains inadequate despite widespread awareness and government initiatives aimed at promoting digital payments. According to the PayNet Digital Payments Insights Study 2022, although digital payments are increasingly accepted by urban SMEs, many businesses, especially in the Southern and East Coast regions, still prefer cash transactions. This regional divide underscores a critical gap in the adoption of QR payments, where factors beyond mere awareness and availability are at play. Research shows that while mobile banking and e-wallets have grown in popularity, particularly among younger generations and urban populations, the same cannot be said for SMEs operating in less developed areas. Digital literacy challenges, infrastructural limitations, and general mistrust towards digital payment systems continue to hinder adoption. Furthermore, the fragmented ecosystem of multiple QR platforms contributes to confusion among SMEs, reducing their willingness to integrate such systems into their business operations.

A major factor contributing to this reluctance is the lack of trust. SMEs often cite concerns over system errors, fraud, and inconsistent platform performance as reasons for their hesitation. Trust, therefore, plays a pivotal role in influencing whether SMEs perceive QR payments as useful and easy to use. Without adequate trust, even high levels of perceived usefulness and ease of use are insufficient to drive adoption. This is consistent with the Technology Acceptance Model (TAM), which has been widely applied to explain technology adoption behavior but often overlooks the mediating role of trust.

Moreover, while existing studies have extensively investigated the factors influencing QR payment adoption, they predominantly focus on consumers rather than SMEs as end-users. The specific dynamics of trust within SMEs remain underexplored, particularly in the context of QR payment adoption. This gap is critical given that SMEs contribute significantly to Malaysia's economy and their adoption of digital payments could enhance financial inclusion and business efficiency.

Furthermore, several government initiatives, such as the MyDigital Economic Blueprint and the Financial Sector Blueprint 2022-2026, emphasize the importance of building a robust and inclusive digital payments infrastructure. These policies aim to promote cashless transactions across all sectors, including SMEs. However, despite such policy efforts, adoption rates remain low in certain regions due to issues of trust, awareness, and infrastructural limitations. Therefore, this study seeks to address these gaps by investigating the mediating role of trust in the relationship between perceived usefulness, perceived ease of use, and QR payment adoption among SMEs in Selangor. By integrating trust into the TAM framework, this research aims to provide a more comprehensive understanding of the factors driving or hindering QR payment adoption, particularly in regions where digital transformation has been slower to progress.

1.5 Research Questions

RQ1 : How does perceived usefulness impact consumer trust in QR payments?

RQ2 : What is the influence of perceived ease of use on consumer trust in QR payments?

RQ3 : What is the relationship between consumer trust and QR payment adoption in Selangor Malaysia?

RQ4 : How does consumer trust mediate the relationship between perceived usefulness, perceived ease of use and QR Payment adoption?

1.6 Research Objectives

RO1 : To examine the impact of perceived usefulness on consumer trust in QR payment systems adoption.

RO2 : To assess the influence of perceived ease of use on consumer trust in QR payment systems adoption.

RO3 : To determine the relationship between consumer trust and QR payment systems adoption in Selangor.

RO4 : To explore the mediating role of consumer trust in the relationship between perceived ease of use, perceived usefulness and QR payments adoption.

1.7 Relevance of the Study

QR payment systems facilitate Malaysia's transition toward cashless payments and enhanced digital accessibility. However, while large corporations find it relatively straightforward to integrate these systems, small and medium enterprises (SMEs) encounter substantial obstacles to implementation. The retail SME market constitutes one of Malaysia's largest sectors, employing a significant portion of the population and making substantial contributions to the national GDP. According to the Department of Statistics Malaysia (2021), SMEs contribute approximately 38.2% to the national GDP and account for nearly 48% of total employment. Therefore, if the retail SME sector does not adopt QR payments through standardized implementation, the nation cannot realistically achieve a cashless society.

The Malaysian government has undertaken various initiatives to facilitate digital transformation, including the National eCommerce Strategic Roadmap (NESR) and the MyDIGITAL blueprint, which delineate plans to enhance cashless adoption and FinTech integration. While these initiatives provide a robust policy framework, their effectiveness is contingent upon widespread SME adoption, which is hindered by trust-

related concerns, inadequate infrastructure, and gaps in digital literacy. Research indicates that a significant number of SMEs cite security risks, lack of knowledge, and unstable internet connectivity as primary reasons for delaying the adoption of digital payments (Kanapathipillai et al., 2024). Consequently, while large corporations leverage financial and technical resources to streamline digital payment integration, SMEs, which often operate with leaner margins, require tailored support mechanisms to transition successfully.

Selangor serves as Malaysia's commercial and financial center and is home to retail SMEs that interact with customers daily. Evaluating retail SMEs in Selangor is therefore pragmatic, as this state represents a microcosm where findings can be applied and replicated elsewhere. Consequently, understanding the key challenges faced by Selangor's retail SMEs will yield relevant and transferable insights that could facilitate QR payment adoption in other Malaysian states. Selangor is an economic hub, contributing significantly to the national GDP, thereby making it a strategic region for studying digital payment behavior (Economic Planning Unit Malaysia, 2022). By focusing on Selangor, this study captures the experiences of SMEs in a highly urbanized and digitally progressive environment, serving as a model for other states aiming to accelerate digital adoption.

This study is distinctive in that it analyzes adoption variables with trust serving as a mediator in the context of QR Payment Adoption (QPA), an aspect frequently overlooked in other QPA studies and the extended Technology Acceptance Model (TAM). While TAM has been extensively utilized to evaluate technological adoption (Davis, 1989; Venkatesh & Bala, 2008), it often neglects the influence of trust, especially in financial transactions where security, reliability, and risk perceptions are paramount (Gefen et al., 2003; Kim et al., 2009). By focusing on retail small and medium-sized enterprises (SMEs) as the study population, the results are grounded in real-world, consumer-driven environments where timeliness is critical, and potential international findings may be inapplicable due to on-site precautionary measures. Unlike multinational retailers, which possess the infrastructure to alleviate cybersecurity risks and financial losses, SMEs are more vulnerable to fraud, transaction failures, and technical disruptions. This further emphasizes the necessity of trust as a fundamental determinant of adoption, as illustrated in studies on digital payment adoption in emerging markets (Kanapathipillai et al., 2024).

Moreover, retail SMEs represent a crucial segment of the Malaysian economy, functioning as entrepreneurial entities within competitive, time-sensitive contexts. For example, if a payment system experiences a malfunction, any disruption in revenue generation can be substantial. Research on cashless payment adoption in Southeast Asia reveals that technical failures, such as issues with QR code scanning or system downtimes, can result in significant revenue losses for SMEs that rely solely on digital transactions (Kanapathipillai et al., 2024). Consequently, ensuring system reliability and security emerges as an essential factor in trust-building and the facilitation of adoption. The base of digital payment systems relies on the use of the internet and without the internet it is impossible to the digital payment systems. The issue of a failed payment system can affect anybody in business and any time. This might affect the operations of the business and cause the operations to be delayed which can eventually affect the economy of the country. These SMEs are the basis of the economy, and the majority of the economy depends upon these SMEs. So, any single issue can result in the economy facing problems.

The findings of this study provide legislative recommendations for policymakers aimed at refining future governmental initiatives within this sub-sector. One critical policy recommendation involves enhancing financial literacy and cybersecurity awareness programs for SMEs, as research indicates that a substantial proportion of SME owners in Malaysia lack formal training in digital financial management

(Kanapathipillai et al., 2024). Furthermore, regulatory bodies, such as Bank Negara Malaysia and the Malaysian Communications and Multimedia Commission (MCMC), must ensure that SMEs are afforded access to secure, cost-effective QR payment platforms equipped with integrated fraud detection mechanisms. Collaborations with FinTech providers and banks could further bolster adoption rates by presenting incentivized digital payment solutions, including fee waivers or rebates for first-time QR payment adopters.

Moreover, this research contributes to the banking and fintech communities by offering alternative options for retail small and medium-sized enterprises (SMEs). By understanding where trust resides on the adoption continuum, banks and fintech companies can implement features and functions that either address security concerns or mitigate adoption challenges, thereby increasing perceived ease of use. For instance, platforms that provide real-time transaction verification, encrypted QR codes, and automatic refunds for failed transactions exhibit a higher adoption rate among SMEs compared to those lacking such features (Kanapathipillai et al., 2024). Such enhancements will not only facilitate the adoption of QR payment systems but also bolster a vital digital ecosystem for individual consumers and small businesses—specifically SMEs—rather than solely large enterprises.

These findings are anticipated to furnish regulators with practical recommendations for refining ongoing initiatives, such as the DuitNow QR standard, and for addressing implementation gaps. The DuitNow QR standard, introduced by Bank Negara Malaysia, aims to unify QR payment platforms under an interoperable system, enabling customers to make payments to merchants across various banks and e-wallets. However, one of the critical limitations remains the inconsistent adoption of DuitNow QR among smaller merchants, many of whom cite high setup costs and a lack of technical support as barriers (Kanapathipillai et al., 2024). In addition, regulators must consider the complexity of fee structures, the level of cybersecurity readiness among SMEs, and the availability of training or educational resources to facilitate the transition to digital payments. By implementing uniform guidelines and collaborating with industry stakeholders, policymakers can foster a more inclusive ecosystem that addresses both technical and financial barriers. Therefore, by highlighting the challenges faced by retail SMEs, this research supports Malaysia’s economic opportunities for financial inclusion and reduced cash dependence.

1.8 Definition of Key Terms

1.8.1 Perceived Usefulness (PU)

The Technology Acceptance Model (TAM) identifies Perceived Usefulness (PU) as a fundamental determinant of technology adoption. PU is defined as "the degree to which a person believes that using a particular system would enhance their job performance" (Davis, 1989, p. 320). In the context of QR Payment Adoption (QPA) among small and medium-sized enterprises (SMEs) in Selangor, Malaysia, PU refers to the extent to which SMEs perceive that implementing QR code payment systems will improve their business operations and facilitate customer transactions. PU is very important in helping people value the use of technology, and people start using technology as a tool to ease their daily tasks. In this respect, the technology acceptance model plays an important part in enhancing the user’s expectations of the technology (Park et al., 2022).

Research indicates that PU significantly influences an individual's intention to utilize technology. Davis (1989) found that users are more likely to adopt a system they believe will enhance their performance. In the case of small businesses considering QR payment systems, PU encompasses perceptions of increased transaction speed, improved customer satisfaction, and streamlined financial processes. For instance, if

merchants believe that QR payments expedite customer transactions, reduce queue lengths, or simplify record-keeping, they are more inclined to incorporate such systems into their daily operations (Rogers, 2003). These citations refer to recognized scholarly works, including Davis's foundational article in MIS Quarterly (1989) and Rogers's well-documented "Diffusion of Innovations" (2003).

One plausible explanation for the strong correlation between PU and technology adoption in this context is that SMEs operate under tight resource constraints and competitive pressures. They often cannot afford inefficient systems that do not provide immediate or tangible benefits. One of the drawbacks in this regard is that sometimes, a QR code scanner can lead the customers to a malicious site, which can result in stealing the information of the customers (Sharevski et al., 2022). Without proper safety percussion, money is stolen through hacking. It can create an issue of distrust, which can affect the business owners very badly that their business can get affected by it. Consequently, when SMEs perceive QR payment systems to be practically beneficial—such as cutting costs associated with cash handling or improving overall customer experience—they become more motivated to integrate these digital payment solutions (Venkatesh & Davis, 2000). This reference is likewise grounded in established literature from Management Science. Additionally, in emerging markets like Malaysia, technological innovations that promise quick returns on investment or enhanced operational efficiency hold particular appeal for SMEs (Kraus et al., 2022). For example, Kraus and colleagues have published on digital entrepreneurship and transformation within SMEs in reputable journals, validating the relevance of these findings.

The dimensions of Perceived Usefulness (PU) can be further categorized into effectiveness, efficiency, and understandability. Effectiveness refers to the extent to which the system accomplishes its intended purpose; efficiency pertains to the resources expended to achieve a specific level of performance; and understandability relates to the ease with which users can comprehend the system's functions (Davis, 1989). An understanding of these dimensions is essential for assessing how small and medium-sized enterprises (SMEs) evaluate the potential benefits of QR Payment Adoption (QPA) systems. Furthermore, the importance of these dimensions is heightened when trust is considered as a mediating factor: SMEs are likely to be more inclined to adopt QR payments if they perceive the system to be secure, reliable, and user-friendly—a perspective supported by the broader literature on digital financial services (Kim et al., 2009).

Connecting PU to the broader conceptual framework of the Technology Acceptance Model (TAM) underscores its interaction with Perceived Ease of Use (PEoU) and trust factors (Gefen et al., 2003). For instance, if a system is perceived as highly useful yet remains complex to deploy, SMEs may still exhibit hesitation in its adoption. Sometimes, SMEs do not have the technical expertise to understand the complexity of the new technology, which can lead the SMEs not to adopt the technologies, as it can be a concern for their budget. Due to having limitations to adopting the technological changes the scope of the progress can not be gained. For that reason, the expertise of the new technology has been needed. They need experts to understand the function of the technologies and bringing experts can cost them more money in their business, which can lead to the issues budget issues for the SMEs. Some SMEs can hesitate to change their systems as the complexity of the new technologies can make them feel tensed in order to delay the operations of the business and gain profitability. Conversely, a system that is both highly useful and user-friendly while also demonstrating robust security features may experience rapid adoption among resource-limited SMEs. These findings are consistent with existing theories that emphasize how perceived benefits, ease of use, and trust collectively influence adoption behavior (Venkatesh & Bala, 2008). Citing

Venkatesh and Bala (2008) is pertinent in this context, as it expands TAM to incorporate interventions and broader determinants of user acceptance.

From an implications standpoint, the significance of PU for QR payment adoption carries several policies and research ramifications. Policymakers could concentrate on developing targeted awareness and training programs that effectively demonstrate the practical advantages of QR payments, such as expedited checkout processes and enhanced transaction records. Adopting the protocols that can lead to a complex payment system, can be one of the ways to attract SMEs to adopt the new technologies in their business. Finding new ways to integrate the new technology with the existing technology can help SMEs to grow more robust ways to build their systems. However, it is the kind of problem to manage new technology within old ones. Appropriate technology has been needed to make these changes. Designing a user-friendly interface can solve the problems of these SMEs, as many SMEs are more prone to adopt easy user-interface-based technologies that ease their business operations and gain them profit more quickly. Additionally, banks and FinTech providers can collaborate to optimize system features that directly impact the day-to-day operations of SMEs, thereby enhancing perceived usefulness. This approach aligns with official initiatives aimed at fostering digital inclusivity and promoting cashless societies, as highlighted in reports from Bank Negara Malaysia (Bank Negara Malaysia, 2021). For future research, longitudinal studies could investigate how variations in perceived usefulness evolve over time as SMEs integrate and become familiar with QR payment systems, yielding deeper insights into how perceived benefits correlate with sustained usage and competitiveness within the local market.

1.8.1.1 Effectiveness

In terms of QR payment systems, efficiency is the performance of the system in executing transactions and the satisfaction of user needs as well as a seamless payment process (Eren, 2022; Shankar & Datta, 2018; Vineetha & -, 2023; Zhong & Moon, 2022). It covers many aspects such as system quality, user experience, security, and the influence it exerts on the user's behavior. A perfect balance of a good quality interface with a secure payment environment can influence people to adopt the technology. So in this regard, the effectiveness of the technology is very important to perceive the value of the system. The value of the payment system depends upon the experience of the user, only the user can increase the value of the payment system and this can impact the popularity of the payment system. Popularity with trust can serve the best result in influencing people to use the system more [profoundly to live their hassle-free and enhance the operations of the business more quickly to boost the economy of the country.

Eren (2022) study stresses the role of system quality in contactless payments customer experience, stating it to be equally important with the service quality. This indicates that the QR payment systems can be valued as to the quality of the system and to the influence it has on the customer experience as a whole.

Additionally, Shankar and Datta (2018) assert that perceived ease of use, perceived usefulness, trust, and self-efficacy create a significant positive impact on mobile payment intention. This means that the success of QR payment systems depend on factors such as ease of use, perceived usefulness, and trust, which impact adoption intention of users.

1.8.1.2 Efficiency

In the context of QR payment systems, efficiency is defined as the system's capacity to complete transactions promptly, satisfy user needs, and provide a seamless experience from initiation to conclusion. The efficiency of the QR payment system is one of the key elements in gaining the popularity of the system. Speed is one of the factors that can affect the user experience, in the current era, people are more

prone to use a system that is technologically very fast and can help people in their daily tasks. For SMEs, the speed of the payment systems is very important to optimise their business operations more quickly to gain the profits of the operations to increase the profitability. Speed can lead to less waiting times and can eventually lead to cost-effectiveness which can help the businesses to enhance their profit more. This definition encompasses both technical elements—such as system quality, stability, and transaction speed—and user-centric factors, including interface simplicity, perceived value, and security. When these components function cohesively, users tend to exhibit elevated levels of trust and satisfaction, ultimately leading to a stronger intention to adopt the technology (Shankar & Datta, 2018).

Importance of System Quality

A study conducted by Eren (2022) highlights the critical importance of system quality in shaping customer experiences in contactless payment systems, indicating that system quality is as essential as service quality in determining user satisfaction. In the realm of QR payment systems, users expect not only accurate and timely transactions but also platforms that are consistently accessible and devoid of technical malfunctions. High system quality conveys reliability, which, in turn, can increase users' confidence and foster a positive perception of the payment solution. This aspect becomes particularly crucial in competitive markets where small and medium-sized enterprises (SMEs) seek to differentiate themselves through expedited and user-friendly payment processes. An efficient payment system is very important not only in the context of Malaysia but all around the world. Any persistent disruptions can lead to a decrease in the quality of the user experience, which can hinder the growth of the payment system. An effective payment system can reduce the burden of managing payment options while using traditional methods. A good system can be safe and user-friendly, which allows to adjust the progress and supports the ope of financial development. To build trust among consumers, it is very important to foster a payment system which secure and reliable, that can help businesses to work more quickly and enhance their business operations. The policies of the country also play an important factor here, as they enable the system to foster a quality system to maintain the flow of the funds which can help to boost the economy of Selangor and also the country of Malaysia.

One plausible explanation for the significant correlation between system quality and user experience is rooted in the heightened expectations of digital consumers. Users who are accustomed to fast-loading applications or instant confirmations may quickly abandon payment platforms that exhibit latency or errors (Shankar & Datta, 2018). In other words, even a minor delay or technical disruption can erode user trust and impede broader adoption rates (Eren, 2022). Consequently, service providers seeking to promote QR payment technologies must prioritize the establishment of reliable infrastructure, comprehensive testing, and ongoing maintenance.

User Experience and Ease of Use

Shankar and Datta (2018) identified perceived ease of use (PEoU), perceived usefulness (PU), trust, and self-efficacy as primary determinants of mobile payment intentions. When extending these findings to QR payment contexts, it is evident that intuitive interfaces and smooth transaction processes contribute to the development of favorable user attitudes. For instance, if a QR payment application features a clean design, minimal procedural steps, and clear error messaging, users may perceive it as more approachable and beneficial (Venkatesh & Davis, 2000). Consequently, such perceptions enhance the likelihood of adoption. User experience is one of the important factors in gaining the trust of customers and influencing the customers to use the system more. Most people in Malaysia have access to smartphones, and with the help of smartphones, they can easily scan QR codes to avail the transactions more easily. QR code enables the

users to finish the transaction more quickly and that results in saving their time to deal with other tasks in their life.

Furthermore, user experience extends beyond mere interface design. Security elements—such as encryption indicators, fraud detection alerts, and transparent data policies—enhance the user's sense of safety, thereby reinforcing trust in the system (Kim et al., 2009). This integration of usability and security measures can be instrumental in persuading first-time users to adopt the platform and encouraging repeat customers to continue their usage.

Transaction Speed and Its Implications

Transaction speed emerges as a critical variable in the efficiency of QR payments. The ability to scan a code, confirm payment, and finalize the transaction within seconds positively correlates with user satisfaction and perceived convenience. In a Turkish study, Eren (2022) found that while information quality and system quality both contribute to a positive customer experience, perceived transaction speed stands out as a key driver of user contentment. From a theoretical standpoint, rapid transaction completion can reduce perceived waiting time, enhance perceived usefulness, and even mitigate concerns related to security vulnerabilities during prolonged data transfers (Davis, 1989).

An additional layer to this discussion involves perceived risk. Although Eren's (2022) research suggests that service quality and perceived risk did not significantly affect customer experience in one context, other scholars argue that perceived risk remains relevant in certain user segments or specific cultural settings (Shankar & Datta, 2018). For example, while highly tech-savvy users might overlook potential data breaches in favor of speed and convenience, more cautious individuals may prioritize risk mitigation features. Consequently, transaction speed, while vital, should be balanced with transparent security protocols.

Implications for Practice and Policy

These findings have notable implications for developers, small and medium-sized enterprises (SMEs), and policymakers. First, QR payment service providers should invest in high-caliber infrastructure and user-centric designs to optimize system quality and streamline the transaction process. Enhancements in reliability and speed can lead to a ripple effect, amplifying user satisfaction, trust, and sustained usage. Second, SMEs can leverage these insights by selecting or partnering with QR platforms known for their efficiency and robust support systems, thereby enhancing the overall customer experience and increasing the likelihood of repeat business.

On the policy front, regulators may need to establish minimum performance benchmarks for digital payment applications, encompassing standards for uptime, response times, and data protection. Such guidelines could safeguard end-users from unreliable or inadequately supported systems, thereby fostering public trust in QR Payment Adoption technologies. Concurrently, consumer education initiatives—emphasizing benefits, safety measures, and best practices—could further accelerate adoption among less tech-savvy demographics (Venkatesh & Bala, 2008). Collectively, these measures contribute to the overarching objective of creating a secure, efficient, and widely accepted digital payment ecosystem.

In summary, the efficiency of QR payment systems hinges upon system quality, user-centric design, and rapid transaction speeds. Each of these factors significantly influences user satisfaction, trust, and the likelihood of adoption. By addressing technical deficiencies, prioritizing user experience, and balancing speed with robust security, stakeholders—including developers, small and medium enterprises (SMEs), and policymakers—can encourage greater acceptance of QR-based payment solutions. Ultimately, a focus

on efficiency aligns with broader technological acceptance theories, where perceived ease of use, usefulness, and trust converge to shape enduring consumer behaviors (Davis, 1989; Kim et al., 2009).

1.8.1.3 Adaptability

Adaptability of QR payment systems means the ability of the system to create a response to the complex surroundings and consumers' different conditions, as well as the capacity to change in a constant environment with technological and market demand (Eren, 2022; Vineetha et M. Tilak, 2023). They support the evidence of Eren (2022) that stresses the three criteria of information quality, system quality, and perceived transaction speed as the weightiest factors in effect on customers experience, which in turn signifies the flexibility of QR payment systems in accommodating customers' needs and expectations.

Apart from that, the research undertaken by Vineetha and - (2023) on the Build of a Secure QR payment system also gives another frame of reference when it comes to understanding adaptability. Design and transparent payment system are key notion that should be taken into account in architecting QR payment systems with tight focus on security of digital transactions exposing them to the evolution of the issues and requirements related to secure transactions.

1.8.2 Perceived Ease of Use

Perceived ease of use is an important concept in TAM and QR payments context in the perception of the user of the degree of difficulty they will encounter while using a certain technology (Shankar & Datta, 2018; Tu et al., 2022; Yan et al., 2021). This impression leads to performance of their behavior and inclination to use technology.

Shane and Datta (2018) suggest that perceived ease of use is understood as the inclination towards a low effort use of a product technology. This definition is in consonance with the TAM, which involves perceived ease of use among the users as a major ingredient that determines their attitude towards technology acceptance.

According to Yan et al. (2021), the reason why mobile payment is more likely to be person's paying intention than other alternatives is that it is faster in a sense. The ability of transaction speed and efficiency to influence how users perceive ease of use of the QR payment systems in this reinforces their significance. Besides that, Tu et. al. (2022) draw the attention to the role of perceived ease of use as an essential element in the adoption of QR code-based mobile payment system, pointing out the impact on users' intention to adopt mobile payment systems. This goes along with the point that the simplicity of use of these technologies (i.e. ease of use) is a crucial component in the process of forming the positive effect of people's attitudes and intentions to use new payment technologies.

1.8.2.1 User Experience

In QR payments context, user experience is the perception and the reaction at the people how they feel after utilizing the QR code payment systems (Chang et al., 2021; Eren, 2022; Luna et al., 2019; Rahayu & Aransyah, 2023; Yan et al., 2021). This encompasses the several characteristics incorporating the factors of operation, safety, speed, or overall level of satisfaction with the whole process of making a payment.

The user interaction while making the QR payments is being impacted by several factors such as system quality, transaction speed, security, and perception of this process simplicity. Luna and colleagues (2019) point out the widespread sharing of QR code among users of these operating system, and that include that face the QR code payment systems which in turn have effects to the user experience when using QR code across the different operating systems.

Yan et al. (2021) indicate that the QR code payments on mobile devices decrease the time required for the process payments and offer those an increased level of convenience. It is this fast transaction that brings new experience of QR payments that compete with payment system based on cards.
Chang et al. (2021) have pointed out that the convenience of QR Code payment systems is that it is flexible and fast, which indicates how such factors could matter for conversing user experience with QR payment systems.

1.8.2.2 Accessibility

Accessibility within the sphere of QR payments implies the utilization opportunities and availability of the system facilities for the customers as well as the modes of access and use for individuals to perform financial transactions (Forgor & Julie, 2020; Klapper, 2023; Liébana-Cabanillas et al., 2020; Wakaba & Wepukhulu, 2019; Yan et al., 2021). It covers many aspects like convenience, accessibility, and user-friendly nature which are all contributing to the final user experience of the QR payments.
Yan et al. (2021) stress the availability of QR code mobile payment asserting that it is always accessible, underlining the convenience and availability of QR code payment systems for users.
Liébana-Cabanillas et al. (2020) reflect on convenience in a sense of a combination of time and place utility, and how to be focusing on accessibility of particular payment systems that users may use.
Klapper (2023) emphasizes for entrepreneurs in particular, those in the emerging markets, that digital payments platforms are not a convenience but a necessity, which highlights the role of accessibility in facilitating entrepreneur financial transactions.

1.8.2.3 User Friendliness

User-friendliness of QR payment systems, as the literature tells, engaged in the initial acceptance process and, most importantly, increases the tendency for continuance (Cao et al., 2018; Liébana-Cabanillas et al., 2015; Lu et al., 2003; Nada et al., 2021; Phương et al., 2020; Rahayu & Aransyah, 2023; Rosnidah et al., 2019; Singh, 2020; Zhou et al., 2021). The acceptance on user's side to mobile QR payments is directly correlated to the future intentions of using the payment systems (Liébana-Cabanillas et al., 2015).
Lu et al. (2003) insist on the user interface, the central part of application delivery, imitating the need of a humanized interface. Moreover, the feature of fastness and convenience give reason that users will pick mobile payment as their choice rather than follow their traditional ways (Rosnidah et al., 2019).
In the scenario of QR code payment systems, the potential use of QR codes is the tool of transferring payments without cash, this makes the payment method unlike other existing ones efficient and convenient (Nada et al., 2021).
The safety of QR code payment systems is also addressed with a number of technologies like cryptography and visual secret sharing involved to increase security and protect against fraud (Zhou et al., 2021).

1.8.3 Consumer Trust

In TAM and QR payment, consumer trust is the trust that consumers have in QR code payment systems that influence their intention to adopt and use these systems (Dickson et al., 2021; Fleischmann & Ivens, 2019; Nguyen et al., 2021; Wei et al., 2020). Trust of consumers is a significant factor in the adoption and usage of the new technologies, among them QR payments.
Nguyen et al. (2021) presents the mediating role of consumer trust regarding m-payment adoption and the significant effect of consumer trust on m-payment adoption, the large variability that consumer trust in m-payment accounts for, which notes trust as a critical driver of consumer behavior in mobile payment technologies.

The study by Wei et al. (2020) emphasizes the role of trust in relation to consumers' intention to adopt new technologies and suggests that trust is one of the significant factors influencing consumers' intention to adopt new technologies in the context of QR payments.

Dickson et al. (2021) extend the TAM model with trust (integrity, benevolence, and competence), to illustrate the reason of consumers' intentions of using e-payment platform, and thus, the elevation of trust on consumers' e-payment platform intentions.

1.8.3.1 Reliability

In relation to QR payments, reliability refers to the ability of QR code payment systems to provide safe and reliable transactions (Eren, 2022; Huang et al., 2020; Kredina et al., 2022; Metri, 2024) . Consistency, security and system stability are among its aspects, which make QR payment system trusty and confident.

Eren (2022) talks about the influence of wrong or outdated information on the view of a consumer regarding the service providers and the service they can provide. He emphasizes the reliability in customer experience. This implies that the dependability of the data and service delivery determines the trust in the service providers and overall dependability of the service.

In his article, Metri (2024) underscores the high reliability of the Quick Response Indonesian Standard (QRIS) as one of the cashless payment methods and elaborates on its various benefits such as instant payment, security, and no charges associated. This highlights the role that reliability plays in determining the user's experience with QR payments.

1.8.3.2 Security

Security with regards to QR payment is the processes and procedures carried out to guarantee the safety, privacy and sanctity of transactions and customer data in QR code payment systems (Chang et al., 2021; Gill et al., 2021; Rathi & Grewal, 2022; Vineetha & -, 2023; Zhou et al., 2021). It consists of several aspects related to data protection, encryption, authentication, and unauthorized access prevention, all essential for creating trust and faith in security of QR payments systems.

Gill et al. (2021) point out that security is the most critical consideration for consumers concerning the process of making mobile financial payments, showing the supreme role of the factor of security in forming the consumers' intention to use mobile payment systems.

Chang et al. (2021) consider perceived security as an important precursor to attitude, stressing the effect of security on customers' attitudes to use QR code payment systems.

Vineetha et al. (2023) focus on the creation and implementation of the secure QR payment system through visual cryptography that highlights the role of security measures in preserving the privacy and confidentiality of holders' information in QR payment system.

1.8.3.3 Responsiveness

Security with regards to QR payment is the processes and procedures carried out to guarantee the safety, privacy and sanctity of transactions and customer data in QR code payment systems (Chang et al., 2021; Gill et al., 2021; Rathi & Grewal, 2022; Vineetha & -, 2023; Zhou et al., 2021). It consists of several aspects related to data protection, encryption, authentication, and unauthorized access prevention, all essential for creating trust and faith in security of QR payments systems.

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Chang et al. (2021) consider perceived security as an important precursor to attitude, stressing the effect of security on customers' attitudes to use QR code payment systems.

Vineetha et al. (2023) center on the development and adoption of a secure QR payment system through visual cryptography, which emphasizes the role of security measures in maintaining privacy and confidentiality of transaction data in QR payment systems.

1.8.4 QR Payment Adoption

QR payment adoption denotes the way consumers and business entities use QR code payment systems to make payments. It is also associated with the transformation of traditional methods of payment to the use of QR codes as the mode of payment that offers convenience, swift transaction, and a contact-free experience (Yan et al., 2021).

QR payment systems adoption is influenced by a number of factors including perceived usefulness and ease of use that are highlighted in the Technology Acceptance Model (TAM) (Davis, 1989), as well as trust. All these factors are very crucial to the users' attitudes and intention towards the QR payment system's acceptance.

In Selangor, Malaysia SMEs environment, QR payment adoption is defined as the implementation and integration of QR code payment systems into their business operations and customer-oriented activities. According to Nada and colleagues (2021), the introduction of QR payment solutions by SMEs would lead to efficiency gains, improved quality of service and increased competition in the market.

QR payment also depends on the external factors such as the government policies, technological infrastructure, and market demands (Chang et al., 2021). Malaysian government initiatives like e-Tunai Rakyat program and Malaysia Digital Economy Blueprint among others have played a great role in promoting the acceptance of the digital payment methods, QR payments inclusive (Central Bank of Malaysia, 2021; Economic Planning Unit, 2021).

Overall, QR payment adoption represents the utilization and usage of QR code payment systems by consumers and businesses, which is defined by the usefulness, ease of use and trust, as well as other elements-such as policy and technology infrastructure. QR payment adoption will result in increased productivity, better customer service, and greater competitiveness for businesses, especially SMEs in Selangor, Malaysia.

1.9 Dissertation Structure

This dissertation research is broken down into five chapters, each of which addresses a particular aspect of the research. The structure of the chapters is as follows:

Chapter 1: Introduction This chapter gives an introduction of the research which includes the study background, problem statement, research questions, research objectives, and significance of the study. It also outlines the objectives and delimitations of the study and the organization of the dissertation.

Chapter 2: The literature review chapter provides a detailed review of the literature related to the study's primary variables, for instance, perceived value and usefulness, trust, and QR payment adoption. It presents a theoretical background of the research, and the main attention is paid to the Technology Acceptance Model (TAM) and its extensions. The chapter also highlights the areas where further research is needed and creates a theoretical framework and hypotheses for the experiment.

Chapter 3: Research Methodology This chapter outlines the research methodology used in the study which includes the research design, sampling technique, data collection method, and data analysis techniques. It gives information about the construction of the survey instrument, the scales of measurement

used and a pilot study that was done to establish the reliability and validity of the instrument. The ethical considerations and the measures taken to maintain integrity of the study are also covered in the chapter.

Chapter 4: Data Analysis and Results The data analysis and results chapter provides the findings of this research that are found based on the data collected from the online survey. This part consists of descriptive statistics of the sample, reliability and validity evaluations of the measurement model, and tests of hypotheses with structural equation modeling (SEM) techniques. In addition, the chapter shows the outcomes of the mediation analysis, trust as a mediator variable between perceived usefulness, perceived value, and QR payment adoption.

Chapter 5: Discussion and Conclusion The last chapter, when discussing the results of the investigation with respect to the research questions and objectives. It places the findings in the context of the current literature and gives a broad outline of the theoretical and the practical implications of the research. The chapter also recognizes the weaknesses of the study and proposes suggestions for research gaps. In the end, it wraps up the dissertation by presenting a brief summary of the main findings and drawing attention to the role that the study plays in the area of mobile payment adoption and trust.

1.10 Limitations and Delimitations

1.10.1 Limitations

The present study, similar to any research work, has some limitations that should be recognized and taken into account in the process of the findings interpretation and conclusions drawing. There are a few limitations of this study and one of them is that it is a cross-sectional type of research study. In cross-sectional study, data is gathered from participants at a single point in time offering a photograph of the relationships between the variables at that time. Although this method is effective in analyzing relationships and correlations between variables, it does not allow to create causal relationships and to study the long-run effects of trust on QR payment adoption.

To determine causality, researchers have to use experimental or longitudinal research designs wherein variables are manipulated, or data is collected from participants over a long time. Nevertheless, the time and resource limitations led to selection of a cross-sectional design for the present study. Hence, the findings should be considered as associations rather than causality, and further research could use alternative research designs to investigate the causal mechanisms of the relationships among trust, perceived usefulness, perceived value, and QR payment adoption.

The second limitation of this study is a quantitative research approach it uses. Among the types of research methods that are used to test such relationships and verify predictions based on established theories are quantitative methods, which include surveys and statistical analyses. Though, these approaches may not completely encompass the intricacies and subtleties of the variables affecting consumer trust and QR payment adoption. Quantitative data gives a general picture of patterns and trends but may not provide a deeper understanding of the individual experiences, perceptions, and decision making of consumers.

For a deeper insight into the phenomenon under study, the further inquiry might utilize qualitative approaches such as interviews or focus groups and combine them with quantitative methods. Qualitative data is capable to give detailed, vivid knowledge about the subjective experiences and beliefs of consumers, to support the data obtained through quantitative analysis. Such integration of both approaches would help researchers to have a comprehensive view on trust and adoption of the QR payment and to identify areas that may be of interest for future exploration or development of theoretical basis.

Moreover, the present research uses self-report data that was gathered through an online survey. Self-report measures are the most commonly used in social science research, but they dramatically suffer from

different types of response biases, which negatively influence the accuracy and reliability of the collected information. For instance, participants may start answering survey questions in a socially desirable way, trying to show themselves in a good light or to conform to what they believe to be socially acceptable. They could also fail to remember their past behaviors or events correctly, which would lead to inaccurate responses.

In order to eliminate the impact of the response biases, the questionnaire in this study was carefully designed to avoid ambiguity and assure precision in the questions posed. Moreover, the anonymity and confidentiality of the participants' responses were guaranteed so that they could easily provide their responses honestly and accurately. Nevertheless, further research could use different data collection techniques like observational studies or objective measures of behavior in order to support the findings conducted with the help of self-report measures and improve the validity of the findings.

Another drawback is that the current study targets only consumers in Selangor, Malaysia; therefore, generalizability of the study findings to other geographical contexts and cultures is limited. Another limitation is the sample size restricted by the scope of the study in the context of time and budget constraints.

Consumer behavior, attitudes, and perceptions are affected by many factors such as cultural norms, socio-economic status, technological infrastructure, and regulatory environments. Therefore, the interrelations among trust, perceived usefulness, perceived value, and QR payment adoption may differ in different regions, countries, or cultural environments.

Nevertheless, the next step would be to repeat the current study in other geographical contexts so as to confirm the relevance and generalizability of the results. Moreover, cross-cultural similarities may be used as a tool to investigate discrepancies in trust-promoting and institutional acceptance factors among various consumer segments. By broadening the scope of the study to consider geographic and cultural environments, researchers will be able to build a more extensive picture of the global status of QR payment adoption and the role of trust in making choices and influencing attitudes and behaviors.

1.10.2 Delimitations

Apart from the restrictions that have been mentioned, it should be noted that the delimitations of the present study. A delimitation is the set of conscious decisions a researcher made regarding where to put the limits of his or her study. The following largely depends on the objectives of the research, theoretical frame, and pragmatic approach of the study and helps in concentrating research on a set of variables, contexts, or technologies.

This study is delimitated by the fact it concentrated on QR payment adoption among consumers in Selangor, Malaysia. This particular geographical context was selected because of its accuracy to the research objectives and the availability of the target population. The state of Selangor in Malaysia is highly urbanized and technologically advanced, having a huge consumer base and an increasing digital payment services ecosystem. The purpose of the study is to examine this region-specific context in more depth and detail, understanding all the factors that influence trust and QR payment adoption by consumers in this area.

Nevertheless, it is essential to appreciate that the results of this study may not be universally valid to other location contexts or consumer groups. The cultural, economic, and technological characteristics of various regions and countries can define consumer patterns in particular ways. Hence, the results of this study could be used as a base for some more general discussions and theoretical advancements in the sphere of

mobile payment adoption, some reservation is required to put such results into other contexts without further empirical tests.

Another limitation of this study is the fact that it concentrates on the mediating role of trust in the relationship between perceived usefulness, perceived value, and QR payment adoption. This study is theoretically guided by the Technology Acceptance Model (TAM) and its subsequent, which focus on the role of perceived usefulness and perceived value in influencing user attitudes and behaviors towards new technologies. The framework introduces trust as the major mediating variable by acknowledging the fact that use of mobile payment services implies risk and uncertainty to the consumers.

The study is to provide a specific and centralized assessment of factors influences QR payment adoption in trust-based perspective focusing on these variables and relations. However, the contribution of other factors and theoretical approaches to understanding the dynamics of mobile payment adoption should not be neglected either. For example, perceived ease of use, social influence, or personal innovativeness can affect consumer attitudes and behavior toward QR payments as well.

However, additional variables and theoretical perspectives could be investigated in the future, that should help to develop a full picture of factors influencing the adoption level of QR payment. Thus, by harmonizing ideas from different theoretical paradigms and incorporating a larger set of variables, researchers can produce a more detailed and advanced model of the adoption of mobile payment that captures the complex interplays between technological, psychological, and contextual aspects.

To conclude, this research is focused specifically on QR payment systems as an exclusive mobile payment technology. QR codes have emerged as the most commonly used and popular technique of mobile transaction enabling, particularly in countries like Malaysia in the Southeast Asia. Targeting the QR payment adoption specifically, this research is aimed at providing more precise results on the determinants of trust and acceptance of this particular technology among consumers.

However, it is important to note that QR payments are only one type of mobile payment technology and other types may have different adoption patterns and trust dynamics, such as the mobile wallets and Near Field Communication (NFC). Every mobile payment technology has distinctive attributes, benefits and challenges, and consumers may perceive and interact with these technologies differently.

Future research could look into the adoption of alternative mobile payment systems and compare its findings with that of the survey on QR payments conducted in this study. When multiple mobile payment technologies are examined together, researchers are able to identify similarities and differences between determinants of trust and adoption across platforms and contexts. This methodological stance allows achieving a broader vision of the mobile payment environment and therefore making targeted campaigns to increase the usage of some technologies within particular customer segments.

To sum up, the limitations and delimitations of this study are very useful as they give context for interpreting the findings and directions for future research. With recognition of limitations and boundaries of the present studies, researchers would be able to offer a more nuanced and critical analysis of the key determinants of QR payment adoption and the role trust plays in shaping consumer behavior and preferences. The research will become even more important in shaping the strategies that will be utilized for promoting adoption and acceptance of mobile payment technologies among various consumers in the world market.

1.11 Chapter Summary

Hence, the chapter brings about the starting point for the study of the mediating function of trust in QR payment adoption among the people living in Selangor, Malaysia. The base of the research pinpointed the relevance of the digital payment system in Malaysia, which is highly promoted by the government's initiatives and through the popularity of QR payment system. The problem statement also highlighted that the factors of trust and adoption of QR payments need investigation, with trust mediates between perceived usefulness, perceived value, and QR payment adoption.

The formulated research questions and objectives set the course of the study aiming to investigate the effects of perceived usefulness and perceived value on consumer trust, the link between trust and QR payment acceptance, as well as the mediating role of trust in the adoption process. The relevance of the study was considered, highlighting its possible implications for these groups: policymakers, financial institutions, traders, and researchers.

The research gap part pointed out the shortage of research that mediate trust role in QR payment adoption within the Malaysian context, which justified this study. It was also noted that the limitations and delimitations of the research provide the avenues for which future research can further on the findings and eliminates the identified gaps.

Finally, the chapter structure gave an outline of the structure of the dissertation, revealing the content and focus of each chapter. Following this will be the literature review chapter, which will provide an extensive review of the current literature related to the main variables of the research and development of the conceptual framework and hypotheses for the research.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Certainly, with new digital payment technology, people across the world can engage in financial transactions almost without limit. At the same time, it offers greater accessibility for international personal, professional, and social activities and often, it advocates for transformation and advancement. The simplest form of a digital payment solution is a QR code payment system, which allows a user to independently conduct a safe, contactless payment transaction with just a smartphone or handheld device. Such an opportunity exists thanks to internet availability via telecommunications devices, the ubiquity of cellular phones in modern society, and the growing use of QR code scanning and related apps by public and private actors across industries ranging from transportation and travel to retail and online shopping.

In terms of Malaysian retail, QR-based innovations possess promising opportunities for the SME-dependent marketplace in Selangor as a low-cost, easy solution for payment processing instead of cash. Essentially, QR payment processing occurs when a consumer enters a retail shop or purchases something online and, using his/her/their personal app, chooses to pay without having to use cash or credit cards. Thus, as a nearly invisible payment processing option that is easy and requires no close, in-person contact with another individual, it appeals to consumers, merchants, and financial service providers looking to embrace digital payment solutions.

Therefore, it is critical to explore what motivates the intent to use QR payments, particularly for retail SMEs in Selangor. From the perspective of the payment ecosystem, the various stakeholder's technology providers, regulators, banks, consumers, and merchants must adjust their behaviors accordingly. Likewise, researchers need to acknowledge this phenomenon to better understand consumers and subsequently

create better interfaces, improve marketing, and strengthen regulatory efforts that facilitate QR payment usage. Indeed, the intent to use QR payment is just as important as understanding why some might refuse to use it.

As part of the analysis in this chapter, the research aims to contribute to the QR payment adoption literature through multiple disciplines, including information systems, economics, sociology, psychology, and marketing. The focus on retail SMEs in Malaysia's key commercial hubs, such as Selangor, adds a critical dimension to the discourse, recognizing the unique barriers and opportunities within this market segment. Serving as the main theoretical framework, the author introduces technology acceptance theory in the context of perceived usefulness, ease of use, and consumer-perceived trust as the key predictors of users' behavioral intentions regarding QR payment systems. The next section expands on the specifics of perceived usefulness and perceived ease of use, detailing how and why users assess both the utility and usability of QR technologies for payment and other financial applications. It also explains consumer trust, describing how confidence, reliability, and security are crucial components of trust in QR payment systems.

Furthermore, a literature review in this chapter examines the adoption patterns of QR payments and the factors that tend to influence users of QR code-based payment systems. This review includes a technological, social, economic, and institutional perspective on the factors shaping adoption behavior but also acknowledges the interdependency of choice factors, such as market dynamics specific to retail SMEs in Selangor. It recognizes, as well, the impact of regulatory frameworks and cultural influences on both firms and individuals.

Finally, the chapter outlines the remaining research questions and recommendations for future research and policy concerning QR payment adoption as a theoretical and empirical tool. This focus is especially relevant to the evolving landscape of digital payments in Selangor's retail sector, where new challenges and interactions continue to emerge.

2.2 Technology Acceptance Model (TAM)

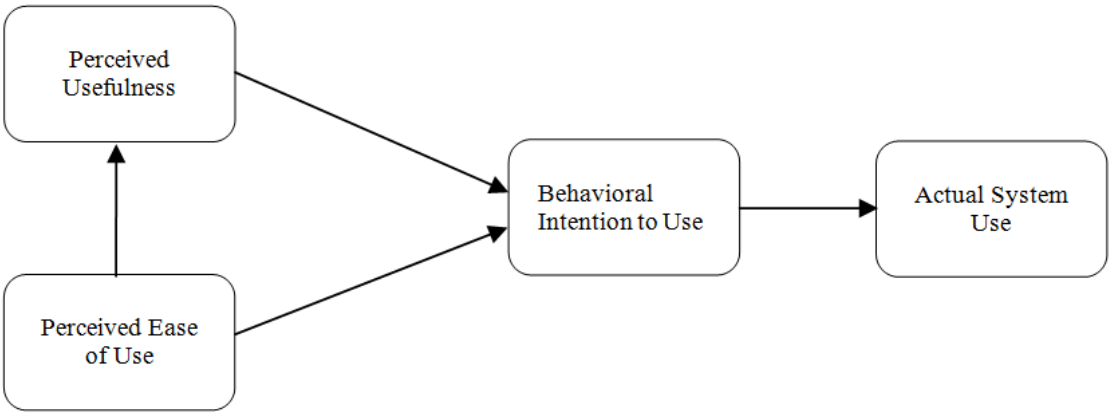

Figure 2.1: Technology Acceptance Model

The Technology Acceptance Model (TAM) serves as a foundational theoretical framework for understanding user adoption of information systems. Initially proposed by Davis (1989), TAM evolved from the Theory of Reasoned Action (TRA) to specifically address technology acceptance behaviors within organizational contexts. The model's persistent influence is attributed to its parsimony and robust explanatory power across diverse technological environments (Venkatesh & Davis, 2000).

The core constructs of TAM—perceived usefulness (PU) and perceived ease of use (PEoU)—have demonstrated remarkable stability across three decades of empirical validation. Davis's initial study established strong reliability coefficients for both PU ($\alpha = 0.97$) and PEoU ($\alpha = 0.91$), thereby laying a foundation for subsequent research. Later meta-analyses conducted by King and He (2006) confirmed the reliability of these constructs across 88 studies, reporting average correlations between behavioral intention and PU ($r = 0.59$) and PEoU ($r = 0.43$).The evolution of TAM reflects the increasing complexity of technological ecosystems. Venkatesh and Davis (2000) introduced TAM2, which incorporated social influence processes and cognitive instrumental processes. This extension accounted for up to 60% of the variance in usage intention, representing a significant advancement over the original model's explanatory power of 40%. Subsequently, Venkatesh and Bala (2008) developed TAM3, which introduced anchoring and adjustment variables to better elucidate the determinants of PEoU.

A notable theoretical advancement arose from the Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), which integrated eight prominent technology acceptance models. The performance expectancy construct of UTAUT, derived from TAM's perceived usefulness, consistently emerged as the strongest predictor of usage intention ($\beta = 0.53$, $p < 0.001$) across various contexts.

2.2.1 Cross-Domain Applications and Validations

Healthcare Technology Implementation

The healthcare sector has yielded valuable insights into the applicability of TAM in high-stakes environments. Holden and Karsh (2010) analyzed 20 studies regarding health information technology adoption, revealing that perceived usefulness exhibited stronger correlations with usage intention among clinicians ($r = 0.76$) compared to administrative staff ($r = 0.52$). This disparity underscores the critical role of clinical utility in the acceptance of healthcare technology.

In the context of telemedicine adoption, Wu and Chen (2021) found that traditional TAM constructs explained 47% of the variance in adoption intention; however, this increased to 72% when accounting for healthcare-specific factors such as patient privacy concerns and infrastructure reliability. The significant moderating effect of these contextual variables ($\beta = 0.38$, $p < 0.001$) underscores the importance of domain-specific model extensions.

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Educational Technology Integration

Educational technology research has revealed distinct patterns in the relationships outlined by the Technology Acceptance Model (TAM). Scherer et al. (2019) conducted a meta-analysis of 124 studies in educational contexts, finding that institutional support significantly moderated the relationship between perceived ease of use (PEoU) and usage intention ($\beta = 0.45$, $p < 0.001$). This finding contrasts with corporate settings, where institutional support typically shows weaker effects.

Financial Technology Innovation

The fintech sector has challenged traditional assumptions of the TAM. Lee and Shin (2018) studied mobile payment adoption among 1,200 users, revealing that trust mechanisms accounted for a greater variance in adoption intention ($R^2 = 0.67$) than core TAM constructs ($R^2 = 0.41$). This finding suggests that security and trust considerations may supersede the perception of usefulness in the context of financial technology.

Manufacturing and Industry 4.0

In manufacturing environments, applications of the TAM have concentrated on the implementation of smart factory technologies. Kumar et al. (2020) found that organizational readiness and technical

infrastructure significantly moderated TAM relationships in the adoption of Industry 4.0. Their structural equation modeling revealed that these organizational factors explained an additional 31% of variance in adoption intention beyond traditional TAM constructs.

Agricultural Technology

The adoption of agricultural technology through the lens of the TAM has revealed unique patterns, particularly in developing regions. Liu et al. (2021) examined the adoption of smart farming technology among 875 farmers, finding that community influence ($\beta = 0.57$) surpassed individual perceptions of usefulness ($\beta = 0.34$) in determining adoption intentions. This finding underscores the significance of social factors in the acceptance of agricultural technology.

Meta-Analyses and Systematic Reviews

The proliferation of Technology Acceptance Model (TAM) studies across diverse contexts has facilitated comprehensive meta-analytic investigations, yielding valuable insights into the model's generalizability and boundary conditions. Turner et al. (2010) conducted a systematic review of 73 TAM studies, revealing significant variations in the strength of relationships between subjective and objective measures of system use. Their analysis indicated that correlations between behavioral intention and actual usage ranged from 0.19 to 0.51, suggesting that contextual factors substantially moderate this relationship.

Cross-Cultural Analysis

Cultural dimensions have emerged as critical moderators of TAM relationships. Schepers and Wetzels (2007) analyzed 63 studies across Western and non-Western contexts, finding that power distance significantly moderated the relationship between subjective norms and usage intention ($\beta = 0.42$, $p < 0.001$ in high power distance cultures; $\beta = 0.23$, $p < 0.01$ in low power distance cultures). This finding highlights the importance of cultural context in technology acceptance patterns.

Temporal Evolution

A longitudinal meta-analysis by Wu and Lu (2013) spanning two decades (1993-2012) revealed noteworthy temporal trends in TAM's predictive power. Their findings demonstrated that while perceived usefulness maintained consistent effect sizes across time periods (mean $r = 0.59$), the influence of perceived ease of use exhibited increasing significance in recent years (mean r increasing from 0.38 to 0.52), possibly reflecting users' growing expectations for intuitive interfaces.

Construct Validity

Ma and Liu (2004) conducted a comprehensive meta-analysis focusing specifically on the relationship between TAM's core constructs. Their analysis of 26 studies revealed a strong correlation between perceived usefulness and perceived ease of use ($r = 0.58$), suggesting potential multicollinearity concerns in some applications of the model.

2.2.2 Critical Analysis and Future Directions

Limitations and Criticisms

Despite TAM's widespread adoption, several limitations warrant attention. Bagozzi (2007) critiqued the model's assumption of a direct relationship between intention and behavior, advocating for more sophisticated theoretical mechanisms linking these constructs. Additionally, Benbasat and Barki (2007) contended that TAM's parsimony, while contributing to its popularity, may oversimplify complex technology acceptance processes.

Research Gaps

Several critical research gaps persist in the TAM literature:

- Limited investigation of post-adoption behavior and system continuance.

- Insufficient attention to emotional and affective factors in technology acceptance.
- Need for more sophisticated modeling of social influence processes.
- Limited understanding of technology acceptance in emerging technological paradigms (e.g., AI, blockchain).

Future Research Directions

Building on these identified gaps, several promising research directions emerge:

- **Integration with Emerging Technologies**: Research should explore the applicability of the Technology Acceptance Model (TAM) to emerging technologies such as artificial intelligence and blockchain systems. Initial work in this area by Lee et al. (2019) suggests that traditional TAM constructs may require substantial modification to adequately capture the unique characteristics of autonomous and decentralized systems.
- **Longitudinal Studies**: There is a pressing need for more longitudinal research to understand how patterns of technological acceptance evolve over time. Burton-Jones and Straub (2006) advocate for more sophisticated conceptualizations of system usage that encompass both the quantity and quality of use over extended periods.
- **Contextual Adaptations**: Future research should concentrate on developing context-specific extensions of TAM while preserving theoretical parsimony. This encompasses investigation: Industry-specific moderating factors, Cultural adaptation frameworks, Organizational context influences and Practical Implications

2.2.3 Implications for practitioners and policymakers:

- **Technology Implementation Strategies**: Organizations should devise implementation strategies that take into account both traditional TAM factors and context-specific variables identified in recent research.
- **User Training Programs**: Training programs ought to be designed to address both utilitarian (perceived usefulness) and hedonic aspects of technology use, as suggested by van der Heijden's (2004) work on hedonic information systems.
- **Policy Development**: Policymakers should consider the complex interplay of individual, organizational, and cultural factors when formulating technology adoption policies.

2.3 Perceived Usefulness (PU)

Perceived Usefulness, Perceived Usefulness (PU) constitutes a fundamental construct within the Technology Acceptance Model (TAM), which aims to elucidate the processes whereby users accept and utilize specific technologies. PU is defined as "the degree to which a person believes that using a particular system would enhance their job performance" (Davis, 1989, p. 320) and has been extensively examined across various domains, including digital payments, e-learning, healthcare technologies, and e-commerce. The rapid advancement of digital technologies has significantly transformed the interactions between individuals and businesses concerning financial services. QR payment systems have emerged as a pivotal innovation within the financial technology (FinTech) sector, providing a swift, secure, and convenient means for conducting transactions. In this context, PU is particularly critical, as it influences both the adoption and sustained utilization of these systems. Users typically assess whether a QR payment system enhances transaction speed, reduces reliance on cash, improves security, and integrates seamlessly with existing financial infrastructures prior to incorporating it into their routine transactions.From a business

perspective, particularly for small and medium enterprises (SMEs), the adoption of QR payments is influenced by PU, given its potential to enhance customer satisfaction, improve cash flow management, and reduce operational costs. For consumers, the decision to adopt QR payments is contingent upon the perceived benefits, such as convenience, reduced transaction times, and assurances of security. Research indicates that individuals are more inclined to embrace a payment technology when they perceive it as advantageous compared to traditional methods, such as cash or credit cards (Chong et al., 2021).As FinTech innovations continue to progress, PU remains a crucial determinant of adoption rates. Understanding the factors that influence PU within the QR payment ecosystem is essential for policymakers, financial institutions, and technology developers to design user-centric solutions that facilitate widespread adoption. This review synthesizes existing literature on PU, elucidating key factors that influence it, its relationships with other constructs in TAM, and its implications for QR payment adoption.In the context of QR payment systems, PU holds particular relevance as it directly impacts users' willingness to adopt such technology. Users frequently evaluate whether the system enhances efficiency, convenience, and security prior to its integration into their financial transactions. This review synthesizes existing literature on PU, highlighting key factors that influence it, its relationships with other constructs in TAM, and its implications for QR payment adoption.

2.3.1 Theoretical Foundation of Perceived Usefulness in TAM

The **Technology Acceptance Model (TAM)** posits that two primary factors determine an individual's acceptance of a technology:

- **Perceived Usefulness (PU)**
- **Perceived Ease of Use (PEoU)** (Davis, 1989)

PU is considered the strongest predictor of technology adoption as it reflects the **instrumental value of the system** in improving work performance and productivity.

TAM has been extended in various ways, including:

- **TAM2 (Venkatesh & Davis, 2000)**
- **Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003)**

These models further emphasize the significance of PU. Research indicates that PU remains a **dominant factor in technology adoption**, often exerting a more substantial effect than PEoU, particularly in mandatory-use environments (King & He, 2006). In the context of **QR payment systems**, PU is assessed based on users' perceptions of how these systems enhance **transaction speed, reduce cash dependency, and improve security**. This aligns with TAM's fundamental premise that users are more likely to adopt a technology when they perceive tangible benefits in its application.

2.3.2 Factors Influencing Perceived Usefulness

- **System Efficiency and Transaction Speed**

System efficiency is a key determinant of perceived usefulness (PU), particularly in financial technologies such as QR payments. Research indicates that users are more likely to perceive a payment system as useful when it reduces the time required for transactions. Faster transaction speeds lead to improved user satisfaction and increase the likelihood of adoption.For example, a study by Cheng et al. (2022) on digital payment systems found that transaction speed significantly correlates with PU, leading to higher adoption rates. This finding is particularly relevant for small and medium enterprises (SMEs), where quick payment processing can enhance operational efficiency.

- **Security and Trust Perceptions**

Security concerns are critical determinants of PU in QR payment adoption. Studies show that if users perceive the system as secure, they are more likely to find it useful. Trust in the security of the system reduces perceived risks, thereby increasing the likelihood of adoption.A study by Liébana-Cabanillas et al. (2020) found that perceived security mediates the relationship between PU and behavioral intention in mobile payment adoption. This suggests that QR payment providers must prioritize encryption, fraud detection, and transaction transparency to enhance PU.

- **Integration with Existing Financial Systems**

The integration of QR payments with existing banking and financial systems influences PU. Users find technology more useful when it seamlessly integrates with their current financial infrastructure. Research by Kalinic et al. (2021) on mobile payment adoption suggests that compatibility with banking applications significantly impacts PU, leading to higher adoption rates among banked populations.For example, in Malaysia, the DuitNow QR system, which integrates multiple payment providers, has increased QR payment adoption by addressing compatibility concerns. This highlights the importance of interoperability in shaping users' perceptions of PU.

- **Social Influence and Subjective Norms**

Social influence plays a vital role in shaping PU, particularly in developing economies where digital literacy varies. According to the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), social norms and peer recommendations significantly impact technology adoption. Studies on mobile payments in China and India suggest that when influential figures (e.g., peers, family members, or businesses) endorse QR payments, users perceive them as more useful. This indicates that marketing strategies leveraging social proof can enhance perceptions of PU.

2.3.3 Relationship Between Perceived Usefulness and Other Constructs

Perceived Usefulness (PU) is not an isolated construct but one that interacts dynamically with several other factors influencing technology adoption. Understanding these interrelationships is crucial in determining the broader impact of PU on technology acceptance, particularly in the context of QR payment systems.

- **Perceived Ease of Use (PEoU) and PU**

Perceived Ease of Use (PEoU) exerts a direct positive effect on PU. Research indicates that when users perceive a system as easy to use, they are more likely to perceive it as useful (Davis, 1989). This correlation arises from the fact that users who find a technology intuitive and effortless are more inclined to focus on its advantages rather than grapple with its complexities. For instance, a study on FinTech adoption in Malaysia demonstrated that simplified QR payment interfaces increase PU, leading to higher adoption rates (Chong et al., 2021). This underscores the necessity for QR payment platforms to optimize their interfaces to enhance both PEoU and PU. Moreover, the perception of ease reduces users' cognitive effort in learning new technology, making the overall experience more positive and reinforcing their belief that the technology is beneficial. However, while PEoU enhances PU, it does not guarantee adoption. Some users may find a system easy to use yet not necessarily useful in their daily transactions. Therefore, addressing PU is crucial for driving long-term adoption and retention of QR payment systems.

- **PU as a Mediator Between Trust and Adoption**

PU has been identified as a mediator in the relationship between trust and technology adoption. Trust is a critical determinant in digital transactions, where security and reliability concerns often influence users' willingness to adopt new financial technologies (Gefen et al., 2003). Users who trust the technology tend to find it more useful, which, in turn, increases their likelihood of adoption. A study on mobile payments

in emerging markets affirms that trust influences PU, which subsequently affects behavioral intentions (Liébana-Cabanillas et al., 2020). This suggests that QR payment providers must prioritize building trust through security guarantees, fraud protection measures, and customer support. Furthermore, PU plays a vital role in bridging the trust gap between perceived risk and adoption. For instance, users may initially be skeptical about QR payments due to security concerns. However, if they perceive tangible benefits—such as speed, convenience, and integration with financial institutions—they are more likely to overcome their hesitation and adopt the technology. Furthermore, a study by Kalinic et al. (2021) on mobile banking adoption highlights that when users perceive high usefulness, trust-related concerns become less significant, reinforcing the notion that demonstrating tangible benefits can mitigate initial scepticism.

- **Perceived Usefulness and Long-Term User Engagement**

While perceived usefulness (PU) significantly influences initial adoption, it also plays a crucial role in long-term user retention. Users may initially adopt QR payments due to perceived usefulness; however, continued engagement depends on whether the system consistently delivers value over time. Factors such as service reliability, ongoing improvements, and enhanced security features contribute to sustained perceptions of usefulness, encouraging prolonged adoption. Research indicates that technologies that fail to evolve with user needs experience a decline in PU, leading to reduced engagement and eventual abandonment (Venkatesh et al., 2003). Therefore, QR payment providers must continuously enhance their offerings by integrating advanced features such as AI-driven fraud detection, personalized transaction recommendations, and seamless cross-platform functionality to maintain user interest. In conclusion, PU interacts with various constructs such as perceived ease of use (PEoU), trust, and long-term engagement, making it a pivotal element in technology adoption. Strengthening PU through user-centric design, security enhancements, and continuous service improvements is essential for ensuring widespread and sustained adoption of QR payment systems.

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PEoU has a direct positive effect on PU. Research indicates that when users perceive a system as easy to use, they are more likely to perceive it as useful (Davis, 1989). This correlation stems from the fact that users who find a technology intuitive and effortless are more inclined to focus on its benefits rather than struggling with its complexities. For instance, a study on FinTech adoption in Malaysia revealed that simplified QR payment interfaces increase PU, leading to higher adoption rates (Chong et al., 2021). This underscores the need for QR payment platforms to optimize their interfaces to enhance both PEoU and PU. Moreover, the perception of ease lowers users' cognitive effort in learning new technology, making the overall experience more positive and reinforcing their belief that the technology is beneficial. However, while PEoU enhances PU, it does not guarantee adoption. Some users may find a system easy to use but not necessarily useful in their daily transactions. Hence, addressing PU is crucial in driving long-term adoption and retention of QR payment systems.

- **PU as a Mediator Between Trust and Adoption**

PU has been found to mediate the relationship between trust and technology adoption. Trust is a critical determinant in digital transactions, where security and reliability concerns often influence users'

willingness to adopt new financial technologies (Gefen et al., 2003). Users who trust the technology find it more useful, which, in turn, increases their adoption likelihood. A study on mobile payments in emerging markets confirms that trust influences PU, which subsequently affects behavioral intentions (Liébana-Cabanillas et al., 2020). This suggests that QR payment providers must focus on building trust through security guarantees, fraud protection measures, and customer support. Additionally, PU plays a vital role in bridging the trust gap between perceived risk and adoption. For instance, users may initially be skeptical about QR payments due to security concerns. However, if they perceive tangible benefits—such as speed, convenience, and integration with financial institutions—they are more likely to overcome their hesitation and adopt the technology. Furthermore, a study by Kalinic et al. (2021) on mobile banking adoption highlights that when users perceive high usefulness, trust-related concerns become less significant, reinforcing the idea that demonstrating real-world benefits can mitigate initial skepticism.

- **PU and Long-Term User Engagement**

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2.4 Perceived Ease of Use (PeoU)

Perceived Ease of Use (PEoU) is one of the fundamental constructs of the **Technology Acceptance Model (TAM)** (Davis, 1989) and is defined as "the degree to which a person believes that using a particular system would be free of effort." It plays a critical role in determining user acceptance of new technologies, particularly in the financial technology (FinTech) sector. The **rise of QR payment systems** has revolutionized digital transactions by providing an easy and contactless payment method. In this context, PEoU serves as a significant determinant of adoption, as it influences user perceptions of accessibility, learnability, and the overall effort required to integrate QR payments into daily transactions. Users tend to evaluate the simplicity of scanning QR codes, navigating payment interfaces, and resolving technical issues prior to fully embracing this method. Moreover, PEoU interacts closely with **Perceived Usefulness (PU)** within the TAM framework, as a system that is perceived to be easy to use is more likely to be regarded as beneficial. This relationship is particularly crucial in the context of QR payment adoption, especially among **Small and Medium Enterprises (SMEs)** and individuals with varying levels of digital literacy. This literature review aims to examine the key factors influencing PEoU, its interrelationship with PU, and its broader implications for the adoption of QR payment systems

2.4.1 Theoretical Foundation of Perceived Ease of Use in TAM

Perceived Ease of Use (PEoU) is a **core determinant** of technology acceptance within the **Technology Acceptance Model (TAM)** (Davis, 1989). It signifies the extent to which users feel comfortable interacting with a technological system without significant cognitive or physical effort.

Over time, TAM has evolved into extended models such as:

- **TAM2 (Venkatesh & Davis, 2000)**, which introduces social and cognitive factors affecting PEoU.
- **Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003)**, which incorporates effort expectancy, a construct similar to PEoU, to explain user adoption.

Empirical studies suggest that PEoU significantly **reduces the cognitive load on users**, making them more willing to adopt digital payment methods (Kalinic et al., 2021). In the context of QR payments, ease of use is enhanced by factors such as **intuitive interface design, efficient scanning capabilities, and seamless transaction processes**. Consequently, users who perceive QR payment systems as easy to use are more likely to trust and adopt them in their financial transactions.

2.4.2 Factors Influencing Perceived Ease of Use

- **User Experience and Interface Design**

The design and usability of QR payment platforms play a crucial role in shaping perceived ease of use (PEoU). A well-designed interface that facilitates easy navigation, provides clear instructions, and ensures fast response times reduces user frustration and enhances engagement (Adeyemi & Issa, 2020). Studies have demonstrated that users prefer payment platforms characterized by minimal steps, large QR code recognition areas, and intuitive prompts that guide them through the transaction process (Kalayou et al., 2020).For small and medium enterprises (SMEs) and older users with limited digital literacy, simplified onboarding processes and interactive tutorials can further improve PEoU and encourage the long-term adoption of QR payment technologies.

- **Prior Technological Experience and Digital Literacy**

Users with prior exposure to mobile banking or contactless payment systems often perceive QR payment systems as easier to use due to familiarity with similar technologies (Mailizar et al., 2021). Conversely, users with minimal exposure to financial technology (FinTech) solutions may encounter significant barriers to adoption due to a lack of digital literacy.Research has indicated that digital literacy training programs can significantly enhance PEoU by building user confidence in engaging with QR payment technologies (Natasia et al., 2022). Governments and financial institutions can facilitate adoption by implementing initiatives that educate users about QR payment functionality, troubleshooting, and security measures.

- **Compatibility with Devices and Infrastructure**

The availability of necessary infrastructure, such as compatible smartphones, stable internet connections, and well-functioning QR code scanners, directly impacts PEoU (Alfadda & Mahdi, 2021). Users who experience technical difficulties, such as poor connectivity or compatibility issues, are likely to perceive QR payment systems as cumbersome and unreliable, thereby diminishing their likelihood of adoption.Studies indicate that enhancing infrastructure reliability and ensuring cross-platform compatibility can improve PEoU and promote the mainstream adoption of QR payment technologies (Kalinic et al., 2021).

- **Social Influence and Peer Recommendations**

Social factors, including peer recommendations, word-of-mouth influence, and societal norms, also shape perceptions of ease of use. Individuals are more inclined to perceive QR payment systems as easy to use

when they receive guidance or recommendations from friends, family, or colleagues (Natasia et al., 2022).Conversely, negative feedback regarding QR payments—such as experiences with failed transactions or security concerns—may lead to perceptions that the system is difficult to use, thereby discouraging adoption. Consequently, positive reinforcement through peer influence and public awareness campaigns can enhance user perceptions of the ease of use of QR payment systems.

2.4.3 Relationship Between Perceived Ease of Use and Other Constructs

- **Perceived Ease of Use and Perceived Usefulness**

Perceived Ease of Use (PEoU) positively influences Perceived Usefulness (PU), as users who find a system easy to navigate are more likely to recognize its benefits (Davis, 1989). The underlying principle of this relationship is that users are more inclined to view technology as advantageous when it does not necessitate extensive effort to learn or operate. When users perceive a system as intuitive and user-friendly, they are more likely to concentrate on its utility rather than on potential frustrations associated with its usage. For instance, a study on QR payment systems in Southeast Asia demonstrated that users who experienced seamless scanning, rapid transaction completion, and minimal technical difficulties were more likely to assess QR payments as useful and reliable (Mailizar et al., 2021). Similarly, research conducted by Chong et al. (2021) confirms that ease of navigation within payment applications significantly enhances perceived usefulness, ultimately leading to increased adoption rates.

Moreover, PEoU plays a crucial role in fostering continuous use of QR payment systems. When initial interactions with a payment platform are characterized by effortlessness, users are more likely to develop long-term positive attitudes towards the system. However, perceived difficulty in using a technology may eclipse its usefulness, prompting users to seek alternative payment methods. This underscores the necessity for ongoing enhancements in QR payment system designs to ensure frictionless user experience and sustained engagement.

- **Perceived Ease of Use as a Mediator Between Trust and Adoption**

Trust is a vital factor in technology adoption, and PEoU serves a mediating role in shaping trust perceptions. When users find QR payment systems easy to understand and navigate, they tend to develop a heightened trust in the technology, which subsequently increases the likelihood of adoption (Gefen et al., 2003). Conversely, if a system is perceived as overly complex, it may elicit skepticism, leading users to question its reliability, security, and overall effectiveness.

A study by Liébana-Cabanillas et al. (2020) found that trust in mobile payment systems is significantly influenced by PEoU. Users who encounter fewer usability challenges tend to perceive the technology as more transparent and secure, reinforcing their willingness to engage in transactions.Furthermore, in emerging markets where digital payment adoption is still evolving, trust concerns are heightened due to potential risks such as fraud and unauthorized access. Research suggests that reducing usability barriers can alleviate trust concerns, as users are more likely to feel in control of their financial transactions when they can easily understand and navigate payment systems (Kalinic et al., 2021). This demonstrates that improving the user-friendliness of QR payment platforms can foster trust, thereby bridging the gap between skepticism and adoption.

- **Perceived Ease of Use (PEoU) and Behavioral Intention to Use Technology**

Beyond influencing perceived usefulness (PU) and trust, perceived ease of use (PEoU) also directly impacts behavioral intention (BI) to use technology. The Technology Acceptance Model (TAM) posits that users are more inclined to adopt a technology if they perceive it as effortless to use (Davis, 1989). Empirical studies reinforce this claim, highlighting that PEoU has a direct and significant impact on user

adoption intentions, particularly in the FinTech and mobile banking sectors (Slade et al., 2015).For QR payment systems, behavioral intention is shaped by multiple ease-of-use factors, such as the simplicity of scanning codes, fast transaction processing, and minimal technical glitches. A study by Zhou et al. (2021) found that users who experienced minimal disruptions in QR payment transactions were more likely to continue using the technology, underscoring the role of uninterrupted user experiences in driving adoption. Additionally, PEoU may be context-dependent, meaning its influence varies based on demographic and situational factors. For example, younger, tech-savvy individuals may be less sensitive to ease-of-use challenges than older consumers, who may require more structured onboarding processes and customer support. Therefore, financial service providers should consider customizing user interfaces and training materials to cater to diverse consumer segments, ensuring that PEoU remains a universal enabler of adoption.

- **PEoU and Long-Term User Engagement**

While PEoU significantly influences initial adoption, it also plays a crucial role in long-term user retention. Users may initially adopt QR payments due to their ease of use, but continued engagement depends on whether the system consistently meets their expectations. If a system becomes difficult to use due to poor updates, technical failures, or lack of support, users may abandon it in favor of more reliable alternatives. Research by Venkatesh et al. (2003) highlights that sustained perceptions of ease of use contribute to habitual technology usage, wherein users integrate digital payment solutions into their daily routines. Continuous improvements, such as AI-driven fraud detection, personalized payment recommendations, and seamless integration with banking services, can help sustain ease of use and ensure prolonged adoption of QPA. Moreover, businesses that accept QPA must prioritize educating users on system updates and troubleshooting techniques. Studies indicate that when users are proactively guided on how to address potential usability challenges, they are less likely to abandon the technology due to minor inconveniences (Kalinic et al., 2021).

In summary, perceived ease of use (PEoU) plays an instrumental role in shaping perceived usefulness (PU), trust, behavioral intentions, and long-term adoption. By focusing on intuitive system design, customer education, and continuous usability enhancements, QPA providers can ensure that ease of use remains a consistent factor in adoption and retention.

- **PEoU and Perceived Usefulness (PU)**

PEoU positively influences PU, as users who find a system easy to use are more likely to recognize its benefits (Davis, 1989). For instance, a study on QPA in Southeast Asia found that users who experienced seamless scanning, rapid transaction completion, and minimal technical difficulties were more likely to perceive QPA as useful and reliable (Mailizar et al., 2021).

- **PEoU as a Mediator Between Trust and Adoption**

Trust is a crucial factor in technology adoption, and PEoU plays a mediating role in shaping trust perceptions. When users find QPA systems easy to understand and navigate, they develop greater trust in technology, which in turn increases the likelihood of adoption (Gefen et al., 2003). Ensuring transparent processes, robust customer support, and secure transactions can enhance both PEoU and trust, thereby encouraging widespread usage.

2.4.4 Implications for Research, Policy, and Practice

- **Research Implications**

Future studies should investigate how demographic factors, including age, education, and socioeconomic background, influence the Perceived Ease of Use (PEoU). Additionally, cross-cultural comparisons may

yield insights into how various societies perceive the usability of QR payments in relation to technological readiness and the development of financial infrastructure.

Further research could also explore how psychological factors, such as consumer anxiety toward technology and perceived behavioral control, moderate the relationship between PEoU and adoption. By examining these variables, scholars can refine existing adoption models to be more inclusive of diverse user experiences. Moreover, longitudinal studies should assess how PEoU evolves over time as users gain familiarity with QR payment technologies. Adoption behavior is dynamic; thus, the factors influencing PEoU may change as the technology matures and as users acquire more experience. Research focusing on habit formation and behavioral persistence in the context of PEoU could provide valuable insights into the long-term adoption of digital payment systems.

- **Policy Implications**

Policymakers should advocate for standardized regulations to ensure that QR payment systems are user-friendly and interoperable. Governments may also consider introducing financial incentives for businesses that adopt QR payments, alongside educational campaigns aimed at enhancing public awareness of their ease of use. Furthermore, policies should be implemented to guarantee that QR payment platforms conform to accessibility standards, thereby enabling users from diverse demographic backgrounds, including elderly individuals and those with disabilities, to engage with digital financial systems effectively. Regulatory bodies must enforce consumer protection measures that mitigate fraudulent activities and ensure that QR payment infrastructures are secure and transparent.

- **Practical Implications**

QR payment providers should prioritize simplified user interfaces, enhanced customer support, and real-time troubleshooting features. Financial institutions can further facilitate adoption by implementing secure authentication measures and fraud protection systems to instill confidence in users regarding the ease of utilizing QR payment platforms. Additionally, businesses should consider the integration of AI-driven personalized user support, chatbots, and interactive onboarding tutorials to improve PEoU for first-time users. Enhancing cross-platform compatibility—ensuring seamless functionality across various operating systems, device types, and financial institutions—would significantly bolster the perceived ease of QR payment systems. Moreover, public-private partnerships should be developed to create inclusive digital payment literacy programs that educate consumers and businesses on the effective use of QR payments. These initiatives would not only enhance PEoU but also promote financial inclusion, particularly among underbanked populations.

2.5 Consumer Trust

Consumer trust (CT) is a critical construct within consumer behavior research, particularly regarding the adoption of digital financial services, e-commerce, and fintech solutions. Trust is typically defined as the willingness of a consumer to rely on a service provider based on positive expectations concerning the provider's ability, integrity, and benevolence (Mayer, Davis, & Schoorman, 1995). It serves as a key antecedent in fostering consumer relationships with digital platforms, thereby shaping their attitudes toward adoption and long-term usage.

In the context of QPA, trust plays a fundamental role in determining whether consumers feel confident in utilizing digital payment platforms for transactions. A lack of trust can create a psychological barrier, causing consumers to hesitate in transitioning from traditional cash or card-based payment methods to digital solutions (Gefen, Karahanna, & Straub, 2003). Given the intangible nature of digital transactions,

consumers must rely on their perceptions of system security, reliability, and vendor credibility when making adoption decisions.

Moreover, trust in digital transactions is multidimensional, influenced by factors such as system security, perceived risk, regulatory support, and prior consumer experiences. Studies have demonstrated that when consumers perceive a payment system as secure, transparent, and supported by institutional frameworks, they exhibit higher trust levels and stronger intentions to use the technology (Luo, Li, Zhang, & Shim, 2010). Additionally, research indicates that trust is dynamic, evolving over time as users engage with digital payment platforms, experience successful transactions, and receive adequate customer support (Kim, Tao, Shin, & Kim, 2010).Furthermore, the role of consumer trust extends beyond individual decision making and influences macro-level digital payment adoption rates. Countries with well-established trust mechanisms—such as robust cybersecurity policies, clear consumer protection laws, and active financial regulation—tend to experience greater acceptance of digital payment innovations (Bank Negara Malaysia, 2021). Consequently, fostering consumer trust through institutional interventions and system enhancements is essential for encouraging QPA and sustaining long-term engagement.This literature review explores the key dimensions of consumer trust in the context of QPA and its implications for businesses and policymakers. By examining the structural, system-based, interpersonal, and experiential dimensions of trust, this review aims to provide a comprehensive understanding of how trust influences consumer decision making in digital payment environments.

2.5.1 Dimensions of Consumer Trust

- **Structural Trust: Institutional and Regulatory Support**

  Institutional trust pertains to consumer confidence in the external regulatory frameworks that govern digital payment systems. Regulatory measures such as data protection laws, cybersecurity policies, and financial consumer protection frameworks are critical in fostering consumer trust (Luo, Li, Zhang, & Shim, 2010). Research indicates that consumers are more inclined to adopt QR payment systems when they perceive adequate government oversight and regulatory enforcement (Kim, Tao, Shin, & Kim, 2010).For instance, in Malaysia, Bank Negara Malaysia (BNM) has implemented the DuitNow QR standard to unify QR payment platforms, thereby ensuring interoperability and security (Bank Negara Malaysia, 2021). Research suggests that when consumers view government intervention as a protective mechanism, they are more likely to trust and adopt fintech solutions (Lai & Lee, 2020).

- **System Trust: Security and Privacy Concerns**

  System trust refers to consumers' belief in the security, reliability, and technical integrity of a digital payment system (McKnight, Choudhury, & Kacmar, 2002). Consumers assess QR payment systems based on encryption measures, fraud detection mechanisms, and transaction transparency.A study conducted by Pavlou and Gefen (2004) found that security concerns are the primary inhibitors of trust in online transactions. Similarly, research on mobile payments highlights that perceived security risks negatively impact adoption intentions, particularly among older consumers and first-time users (Kim, Ferrin, & Rao, 2008). Enhancing QR payment security through multi-factor authentication, tokenization, and real-time fraud monitoring can alleviate consumer distrust.

  Privacy concerns also play a significant role in shaping trust in digital payments. Studies indicate that consumers are more likely to adopt QR payments when companies transparently communicate how personal data is collected, stored, and protected (Beldad, de Jong, & Steehouder, 2010). Thus, transparent data policies and adherence to international privacy regulations (e.g., GDPR, PDPA) can bolster consumer trust in QR transactions.

- **Interpersonal Trust: Brand and Vendor Reputation**
  Interpersonal trust refers to the trust established between consumers and businesses based on prior interactions, online reviews, and brand reputation (Gefen & Straub, 2004). Businesses that cultivate strong brand trust through positive word-of-mouth, high service quality, and ethical conduct tend to experience higher QR payment adoption rates (Jarvenpaa, Tractinsky, & Vitale, 2000).
  Empirical studies demonstrate that consumers tend to trust fintech platforms associated with established financial institutions, such as banks, more than newer entrants in the market (Lai, 2021). Additionally, trust is reinforced when QR payment providers present responsive customer support, clear refund policies, and effective dispute resolution mechanisms (Chang, Cheung, & Lai, 2005).
- **Experience-Based Trust: User Familiarity and Learning Effects**
  Trust in QR payment adoption is also influenced by prior usage experience. According to Davis, Bagozzi, and Warshaw (1989), perceived ease of use (PEoU) and perceived usefulness (PU) significantly affect consumer trust in new technologies. Consumers who have successfully utilized QR payment systems in the past are more likely to continue using them due to increased confidence and reduced perceived risk (Venkatesh, Thong, & Xu, 2012).Studies further indicate that consumers unfamiliar with QR payments exhibit greater hesitation due to uncertainty avoidance (Hofstede, 2001). Providing educational campaigns, hands-on demonstrations, and user incentives can enhance familiarity and subsequently bolster consumer trust (Chong, 2013).

2.5.2 Iplications for Research and Policy

- **Implications for Research**
  Future research should concentrate on longitudinal studies to investigate how consumer trust in QR payments evolves over time, particularly in response to technological advancements, cybersecurity threats, and regulatory changes. Understanding trust dynamics over an extended period can provide insights into how users develop and sustain trust in digital payment systems, identifying critical factors that contribute to long-term adoption.
  Additionally, cross-cultural studies can examine how trust dimensions vary across different socio-economic and regulatory environments (Zhou, 2011). Cultural factors, such as uncertainty avoidance, collectivism, and levels of institutional trust, may influence consumer perceptions of digital payment security and reliability. Comparing consumer trust across diverse markets can assist policymakers and businesses in tailoring their strategies to specific cultural contexts. Moreover, given the rapid advancements in fintech, studies should also explore the role of artificial intelligence (AI) and blockchain in enhancing trust in digital transactions. AI-driven fraud detection systems and the decentralized nature of blockchain can improve transparency, security, and reliability, thereby increasing consumer trust (Kim, Tao, Shin, & Kim, 2010). Future research should investigate how these technologies shape consumer perceptions and whether their integration leads to higher adoption rates of QR payment systems. Another promising research area involves the psychological and behavioral factors that influence consumer trust in QR payments. Studies that integrate behavioral economics and psychology can offer a deeper understanding of trust formation, risk perception, and digital payment habits. Identifying psychological drivers can assist in designing more effective strategies for building trust.
- **Implications for Policy**
  Policymakers should prioritize the development of consumer protection policies that address data security, fraud prevention, and financial literacy. Given the increasing prevalence of cyber threats

targeting digital financial transactions, robust cybersecurity laws and data protection frameworks should be established to safeguard consumer trust. Regulatory bodies should also enforce standardized security protocols across all QR payment providers to ensure a consistent and trustworthy user experience (Bank Negara Malaysia, 2021). Beyond regulation, governments should implement financial literacy programs to educate consumers about digital payment safety, fraud awareness, and secure transaction practices. A well-informed consumer base is more likely to engage with digital payment technologies confidently, thereby reducing hesitation and increasing adoption rates. Public-private partnerships can further enhance consumer trust by fostering transparent regulatory frameworks and industry self-regulation. Government agencies and fintech companies should collaborate to implement cybersecurity awareness programs, promoting best practices and ensuring that users understand how to protect themselves from fraudulent activities (Luo et al., 2010). Strengthening communication channels between regulators and fintech providers can lead to improved trust mechanisms and greater accountability in the digital payment ecosystem. Finally, policymakers should explore the integration of digital identity verification systems, such as biometric authentication and national digital IDs, to enhance trust in QR payments. Implementing secure identity solutions can minimize fraud risks and reassure users about the safety of digital transactions, fostering long-term confidence in cashless payment solutions.

2.5.3 Conclusive summary for Consumer Trust

Consumer trust is a multidimensional construct that plays a critical role in QR Payment Adoption (QPA), but its significance extends beyond technology acceptance into psychological and behavioral domains. Institutional trust, system trust, interpersonal trust, and experience-based trust collectively influence user attitudes toward digital payments, shaping both cognitive and emotional responses to digital financial interactions. Psychological research suggests that trust is foundational in reducing uncertainty and mitigating perceived risks associated with online transactions (Gefen, Karahanna, & Straub, 2003). When consumers trust a digital payment system, they experience lower cognitive stress and greater confidence in transaction security, fostering a positive adoption experience.

From a behavioral perspective, trust serves as a critical determinant of long-term engagement with digital financial services. Studies indicate that when trust is established, consumers exhibit higher levels of loyalty, recommendation behaviors, and willingness to engage in repeated transactions (Kim, Ferrin, & Rao, 2008). Trust also enhances users' perceptions of control, which in turn promotes their willingness to transition from traditional payment methods to QR-based transactions (Luo, Li, Zhang, & Shim, 2010). Additionally, trust interacts with factors such as risk perception and habit formation, playing a crucial role in shaping the psychological comfort consumers feel when adopting new payment technologies (McKnight, Choudhury, & Kacmar, 2002).Beyond individual adoption behavior, consumer trust also contributes to market stability and the growth of the financial ecosystem. A well-trusted QR payment system leads to increased participation, fostering a more inclusive digital economy where consumers and merchants engage with minimal hesitation (Beldad, de Jong, & Steehouder, 2010). Therefore, governments and financial institutions must not only focus on technical improvements but also implement strategies aimed at reinforcing psychological safety and trust perception. By addressing security concerns, providing regulatory support, and enhancing consumer education, stakeholders can improve trust in QR payment systems and drive widespread adoption, ensuring both psychological assurance and technological reliability.

2.6 QR payment Adoption

The adoption of Quick Response (QR) payment systems represents a significant advancement in the digital financial landscape, particularly in emerging markets where cashless transactions are experiencing rapid growth (Lai, 2021). QR payment adoption (QPA) refers to the extent to which consumers and businesses integrate QR-based payment solutions into their financial transactions. As a subset of mobile payment systems, QR payments offer advantages such as convenience, security, and efficiency (Dahlberg, Guo, & Ondrus, 2015). However, the widespread adoption of these systems is contingent upon various factors, including technological infrastructure, consumer trust, regulatory frameworks, and socio-cultural influences (Zhou, 2013).The significance of QR payment adoption extends beyond merely facilitating cashless transactions; it epitomizes a paradigm shift in consumer financial behavior. Research indicates that QR payments contribute to financial inclusion, particularly in developing economies where traditional banking infrastructure is limited (Hasan, Shams, & Rahman, 2021). By diminishing reliance on physical cash, QR payment systems facilitate broader access to digital financial services, fostering increased economic participation.

Moreover, QR payments are associated with enhanced transaction efficiency and consumer satisfaction. Studies indicate that the adoption of digital payments correlates with higher consumer spending, decreased transaction times, and improved customer experiences within retail settings (Shankar & Datta, 2018). The seamless nature of QR payments—characterized by minimal steps, instant processing, and a reduced reliance on hardware—has been identified as a key driver of their adoption (Venkatesh, Thong, & Xu, 2012).

Despite these advantages, QR payment adoption remains uneven across various demographic and socio-economic groups. Older consumers and individuals with lower levels of technological literacy often exhibit hesitance toward adopting digital payment solutions due to concerns regarding security, usability, and lack of familiarity (Zhou, 2013). Additionally, businesses located in areas with poor internet connectivity and inconsistent regulatory policies encounter significant challenges in integrating QR payments into their operations (Malaquias & Hwang, 2016).

Understanding the determinants of QR payment adoption is essential for policymakers, financial institutions, and businesses seeking to enhance digital payment penetration. This literature review examines key theoretical perspectives, adoption drivers, barriers, and implications for research and policy. By analyzing these dimensions, we can gain a deeper understanding of the factors influencing consumer and business adoption of QR payments and develop strategies to enhance financial inclusivity, security, and trust within digital payment ecosystems.

2.7 The Role of Social Influence in QR Payment Adoption

Peer Influence and Word-of-Mouth Recommendations

To adopt QR payment, consumer decisions are influenced by peer influence. The good news is that people who see their friends, family or colleagues using QR payments, for example, will tend to use the technology too (Ebubedike et al., 2022). A survey conducted by Bank Negara Malaysia in 2023 revealed that 72% of the people who made QR payments in Selangor began to use the service because their peers had recommended it. The study also revealed that trust in QR payments is higher when it is observed to occur among close social circles. One example is how Touch ‘n Go eWallet thrived due partly to word-of-mouth promotion because many Malaysians themselves urged their peers to adopt the Payment platform for payment of toll, shopping, and meal purchases (Loke et al., 2022).

Social Media and Digital Marketing

Specifically, social media platforms are utilized by influencers for endorsing QR payment adoption as well as by conducting targeted digital marketing campaigns.

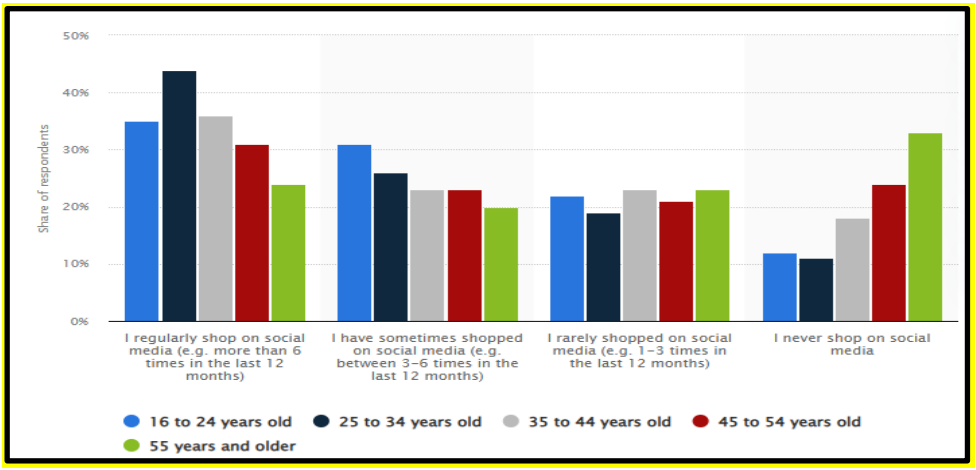


Figure 2.7: Frequency of purchasing something from social media Malaysia 2023, by age

(Source: Statista, 2023)

A Statista (2023) poll found that 60% of Malaysians aged 18-35 were persuaded to use digital payments through social media ads or influencer recommendations. Influencers are actively roped in by e-wallet providers such as GrabPay, ShopeePay, and DuitNow QR for live demo-based seamless transaction promotion with discount offers. In addition to that brands even run promotions such as cashback incentives and referral bonuses to make them use QR payment (Hahn, 2022). ShopeePay's "Scan & Pay" campaign that gave first-time QR payment users 30% cashback saw a 40% increase in transactions within three months in 2022.

Government and Institutional Influence

It is the Malaysian government that has played a big role in making QR Payments trusted and socially accepted. Such initiatives as eBeliaRahmah with RM200 e-wallet credits for eligible youths in 2023 played a key role in the uptake of initiatives.

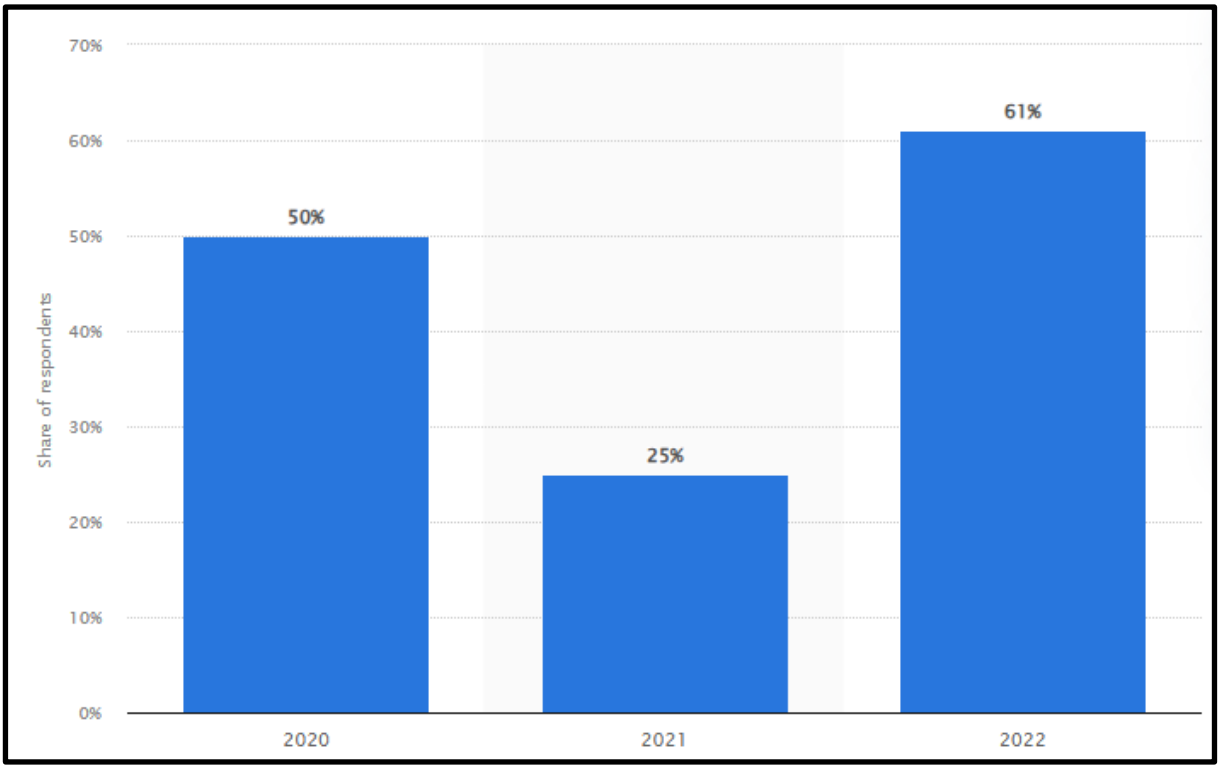


Figure 2.7.1: Usage of QR code payment in Malaysia 2020-2022
(Source: Statista, 2024)

According to a survey in 2022, 61 percent of respondents in Malaysia said they have used quick response (QR) code payment, an increase from 25% of respondents in the previous year (Statista, 2024). The Ministry of Finance said that the program had a 45% rise in QR payment transactions among the younger generation. In line with the government's Malaysia Digital Economy Blueprint (MyDIGITAL), which seeks to have the adoption rate of QR payments to 9% of SMEs by 2025, the promotion of QR payments as a form of digital payments will help build consumers' trust in them (Kamaruddin et al., 2023).

Merchant Adoption and Network Effects

The more businesses that accept QR payments, the more it will force customers to use those QR payments. According to a Malaysia Digital Economy Corporation (MDEC) survey 2023, Selangor's 85% of small and medium enterprises (SMEs) now take QR payments from 60% in 2020 (Gan et al., 2023). The widespread merchant adoption it begins to be a network effect threshold, consumers want to use their QR payments since they have it available. For instance, Tesco, 7-Eleven, and McDonald's have incorporated several QR payment options in cashless transactions for the customer's convenience (Freathy, 2003). Because QR payments begin without having to enter card details or bank information, trust and familiarity of the system increase, and more people become comfortable with using it.

2.8 Cross-Cultural Studies on Trust and QR Payment Adoption

Trust Levels in QR Payments: A Global Comparison

QR payments are trusted to different degrees in different regions. According to a 2023 Statista study, 82% of Chinese consumers would trust QR payments and the same applies to only 68% of Malaysians (Nguyen & Alang, 2024). Most of the higher trust levels in China most likely have an early adoption of QR payment systems within WeChat Pay and alipay that are embedded deeply into daily transactions. Whereas driven by the quick adoption in Japan and Asia, the adoption rates in the U.S. and Germany have remained slower,

with only 45% of Americans (according to a 2022 Pew Research report) trusting QR payments on a daily basis (GURGU, 2019). It is important to note that familiarity, regulation, and technological infrastructure can all affect the level of trust between consumers and companies.

The Role of Regulatory Frameworks

A good regulatory framework provides trust in the use of QR payments by consumers. Strong consumer protection measures in China and Singapore have given countries with such stringent digital payment regulations higher adoption rates (Kosim & Legowo, 2021). Accordingly, data encryption at the Chinese People's Bank of China (PBOC), limits the risk of fraud. For instance, the Monetary Authority (MAS) of Singapore also mandates multi-factor authentication for QR transactions. Bank Negara Malaysia (BNM) in Malaysia, has introduced QR payment guidelines in the form of DuitNow QR in order to standardize and secure transactions (Soo et al., 2023). Nevertheless, despite these efforts, gaps remain in fraud detection as well as consumer education which contributes to the lowering of trust levels.

Cybersecurity Concerns and Fraud Risks

Fraud is one of the major barriers of the use of QR payment in Malaysia (Mansourah Banon Hosany & Rubasundram, 2020). In fact, the QR payment fraud cases grew by 30% year-on-year, said the National Scam Response Centre in a report (2022), taking advantage of fake QR codes to steal personal data and funds. However, the AI security measures in China have reduced such fraud cases in a big way to those that have been caught (Blauth et al., 2022). While this is being implemented by the Malaysian government, consumers remain wary of security threats.

Cultural Attitudes Toward Digital Payments

Malaysia can benefit from global leaders that are famous for QR payment adoption to instill trust among consumers. Malaysia can incorporate in its blockchain technology to enhance the integration of financial literacy programs and transaction security as in China, particularly in Singapore (Irma Naddiya Mushaddik & Wahed, 2023). Additionally, India's experience with the Unified Payments Interface (UPI) for inter-banking QR transactions could be useful in improving the DuitNow QR in Malaysia. To bridge the trust gap, Malaysia can strengthen fraud detection, raise consumer awareness, and enforce stricter cybersecurity regulations to make QR payments more widespread (Wilson et al., 2023).

In addition, the Trust in QR payments is influenced by cultural factors. Both in Japan and in Germany, consumers want to pay in cash because of such habits of deep-rooted financial culture of privacy and security. A 2022 McKinsey report revealed that 74% of Germans still prefer cash, versus digital alternatives (McKinsey, 2024). However, China, India, and Indonesia have rapidly taken up QR payments because of strong government-led digitalization. Comparatively, Malaysia is somewhere in between, where younger consumers are more liberal about making digital payments but more mature generations are hesitant to depend on digital payments because they are not well-versed with digital literacy or are afraid of cyber threats (Al-Qudah et al., 2024).

2.9 The Economic Impact of QR Payment Adoption on SMEs

Increased Sales and Revenue Growth

QR payments have come a long way to help any small and medium enterprises (SMEs) adoption of QR payments has dramatically transformed the economic landscape for SMEs in Malaysia (Klenam Korbla Ledi et al., 2023).

The increase in sales and revenue is one of the main benefits of SMEs using QR payment. Factoring the digital payments, consumers spend much higher compared to the real payments. According to the 2023 report by Bank Negara Malaysia (BNM), it found that SMEs that used QR payments experienced a 25%

increase in sales compared to those who only use cash transactions (Nafilah Rahma Firdausi & Antonio, 2025). Over time, it becomes even more attractive for businesses to accept QR payments because younger and tech-savvy customers who favor digital transactions are more likely to patronize such businesses (Nafilah Rahma Firdausi & Antonio, 2025). For instance, it would be an example for local retailers in Selangor that once the integration of Duit-Now QR payment, their daily transactions will be 30% higher in six months.

Cost Reduction and Financial Efficiency

The adoption of QR payment brings down the operational costs in handling cash, which of course is made up of risks from the security of the cash, the cash deposits, and the loss of counterfeit money. Similar to traditional card payments, QR transactions require no infrastructure other than the POS and is therefore much more economical. A 2022 Malaysia Digital Economy Corporation (MDEC) study on SMEs found that this switch resulted in 40 percent reduction in transaction processing costs from those using debit or credit card terminals. In addition, some platforms like GrabPay, Touch ‘n Go eWallet, and ShopeePay can also optimize their cash flow through instant settlement and lower transaction fees for SMEs.

Improved Financial Inclusion for SMEs

QR payments have played a big role in extending the reach of the digital economy to new unbanked and under-served SMEs (Manoj Kumar M et al., 2024). Previously, many small businesses operating in rural and semi-urban areas had been unable to embrace cash for a simple reason—lack of banking access. But with QR payments, only a smartphone, and the internet, even micro-enterprises can accept digital payments now. According to a 2023 study by the World Bank, 70% of Malaysian SMEs who went digital banking through QR Payments had no prior digital banking experience (Soo et al., 2023). It not only serves as a means to boost business efficiency but also helps SMEs to establish a financial history that leads to the ability to obtain business loans and credit from financial institutions.

Consumer Behavior and Digital Payment Preferences

The trend towards QR payments is a reflection of the shifting preference of consumers for services to be delivered most conveniently and securely.

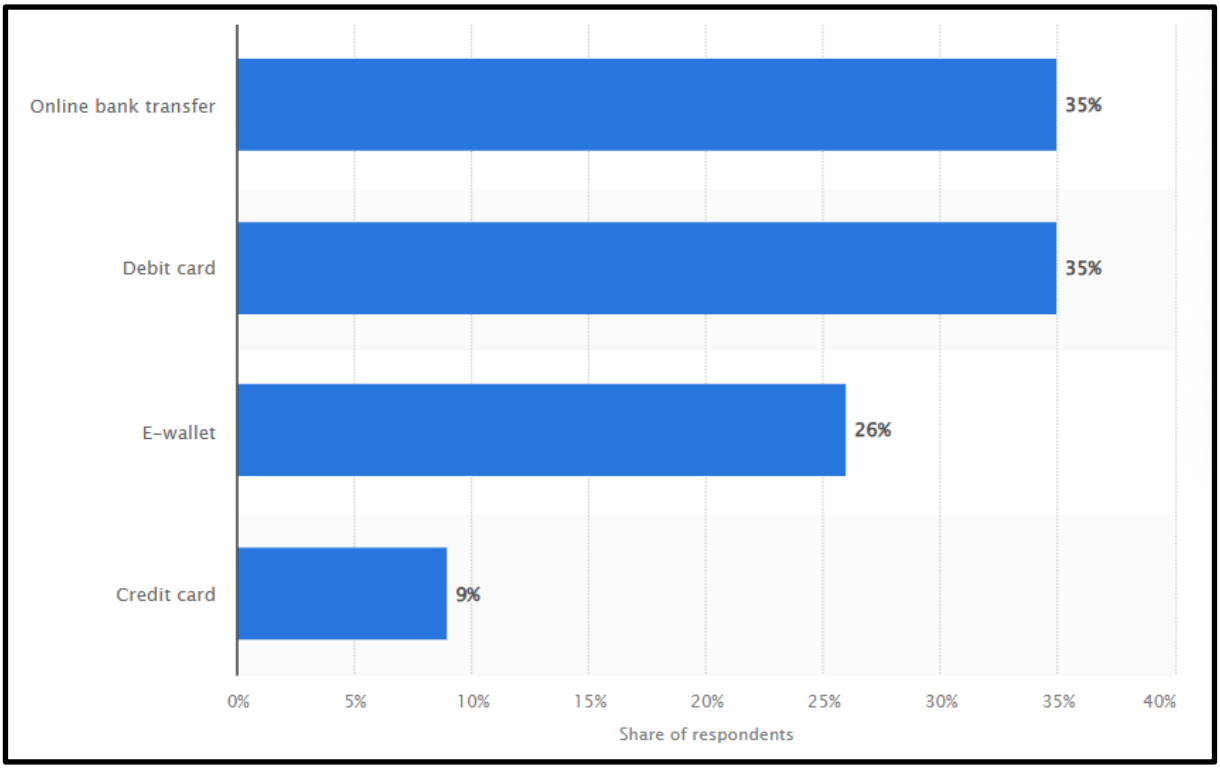


Figure 2.9: Usage of cashless payment among consumers in Malaysia in 2023, by type
(Source: Statista, 2022)

According to a survey in 2023, 35% of respondents in Malaysia have used online bank transfers as well as debit cards, making these the two most popular cashless payment methods. For instance, if SMEs do not adopt QR payments, customers may switch to competitors offering digital payment options. Moreover, QR payments enable the online-to-offline (O2O) integration of businesses that can seamlessly function both in the physical and digital space to augment their market. For instance, the usage of QR payments by small F&B vendors in Malaysia has benefited from a 35% increase in the number of people returning as they find it easy to pay (Abdul-Halim et al., 2021).

However, the benefits of QR payment technology cannot be fully realized by SMEs. Some do not have digital literacy, and others are worried about cybersecurity threats and all the dangers of fraud. SMEs suffer 25% of incidents of QR payment scam that, hence, erodes trust in the system, says CyberSecurity Malaysia (2023). This is however improving as government efforts such as Malaysia Digital Economy Blueprint (MyDIGITAL) continue as well as fraud detection deems more effective.

2.10 The Future of QR Payment Technology: Innovations and Trends

The development of QR payment technology is driven by the constant evolution of security, artificial intelligence (AI), and incorporating blockchain (Dhar Dwivedi et al., 2021). Biometric authentication for QR transactions is one of the key innovations, as it secures the QR transaction feature with fingerprint or facial recognition. For the third year in a row, the Statista 2023 report found that 56% of global consumers still prefer biometric verification instead of the usual PIN for digital payments. In addition, real-time suspicious QR transaction detection is being documented using AI-powered fraud detection systems to reduce scam risks to a great extent (Faccia, 2023). Innovation in these things will bring in Increased security and wider adoption in QR payment of industries.

Another obvious trend is the merging of the cross-border QR payment systems which enables effortless transactions between different nations (Qadri, 2023). Such as Singapore, Malaysia, Indonesia and Thailand

have launched an interoperable QR payment system that will allow people to use their home country eWallets at other Southeast Asian countries. As Malaysia's Bank Negara Malaysia (2023) points out, cross-border QR payments in the country rose by 45% last year, lessening reliance on cash and currency exchange charges. The rise of this trend is likely due to the fact that more countries are adopting unified QR payment frameworks and as they advance their financial inclusion and tourism-friendly payment solutions.

The future looks toward the use of blockchain-based QR payments which will revolutionize the industry as they offer them as a decentralized and tamper-proof transaction (Amit Kumar Tyagi, 2024). Major financial institutions like Visa and Mastercard are looking into how to integrate blockchain in its business as blockchain can make transactions more transparent and efficient. Furthermore, smart contract-enabled QR payments will simplify the transaction processes automatically depending on what conditions were given by the businesses involved (Amit Kumar Tyagi, 2024). With digital currencies becoming increasingly popular, it is also expected for central bank digital currencies (CBDCs) to be integrated into QR payment systems for even faster and more secure transactions. These innovations herald that the usage of QR technology on the payment field will grow globally.

2.11 2.11 Adoption and evolution of the systems of QR payment across emerging markets

2.11.1 International trends to adopt QR payment

Systems of QR payment have achieved international prominence being a major driver of the digital transactions, especially across emerging markets having mobile-first thriving economies. Such payment systems exploit quick codes of responses to facilitate a smooth transaction, successfully eliminating the requirement of traditional card-based or physical cash payments (Onumadu & Abroshan, 2024). This continuous adoption has been attributed largely to the developing penetration of enhanced Internet connectivity, increasing customer preference and smartphones for the methods of contactless payment.

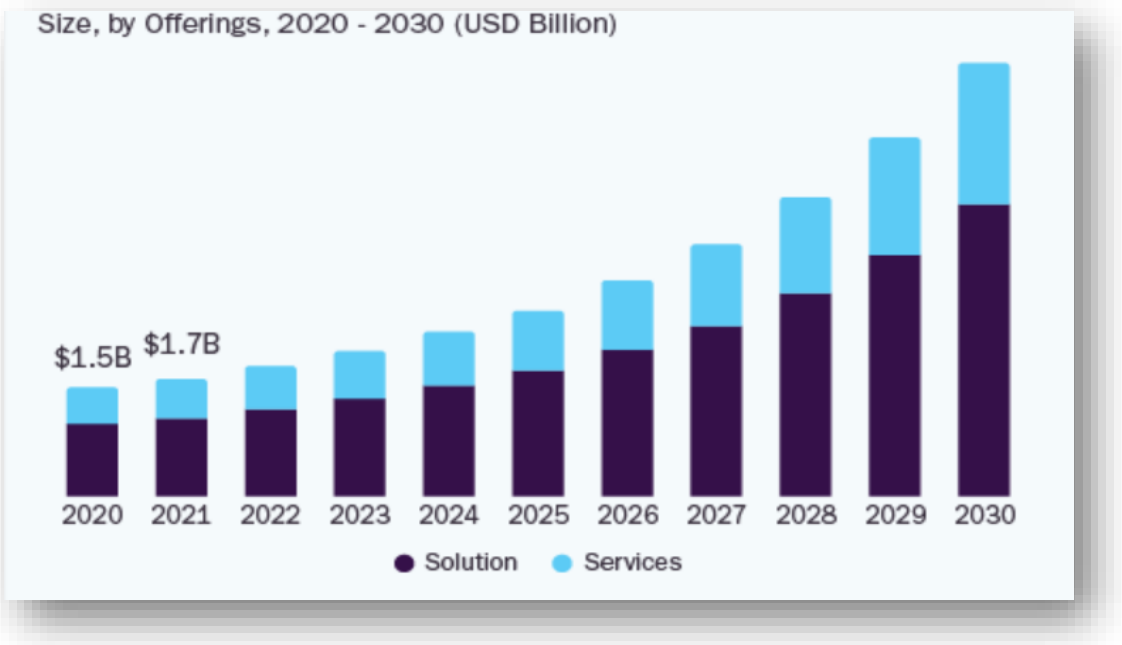


Figure 2.11.1: Market size of QR code payments

(Source: Grandviewresearch, 2023)

Asia, particularly India and China have witnessed massive growth in the adoption of QR payment. In China, WeChat Pay and Alipay have dominated the entire environment, processing collectively more than 17 trillion dollars per year of transactions (Statista, 2024a). This wide usage has been supported by the well-integrated ecosystem where businesses and customers alike depend on the mobile wallets to make everyday transactions. Government policies including the push towards a cashless Society in China have accelerated that option of QR payment further.

India has been a major player in adopting QR payments in the global market as well. The "unified payment interface" backed by the government has successfully transformed the landscape of digital payment in the nation, recording more than 1.5 trillion dollars across transactions (Pib.gov, 2024). The interior probability of UPI between different providers of financial services has promoted widespread customer and merchant adoption. The same trends have been observed across "Southeast Asia", where QR-based and digital wallet payments have been replacing the methods of traditional marketing.

Thailand, Indonesia, Vietnam and Malaysia have witnessed specific growth in the adoption of QR payment because of the increasing regulatory support, shifting customer behaviours and fintech innovation. In particular, Malaysia has positioned as a major leader across digital transactions, gaining an almost 72% increase across the transactions of e-wallets in 2022 (Bnm.gov, 2023).

2.11.2 Adoption Across Malaysia

Malaysia has integrated the QR payments rapidly into their financial system, driven by a strong initiative by the government and increasing customer demand for the digital transactions. Introduction of the DuitNow QR By the "Bank Negara Malaysia" in 2019 focused on standardising QR payments in different providers of payment services (Susilo, 2024). This initiative pushed almost 86% growth in the transactions of QR payments by 2021.

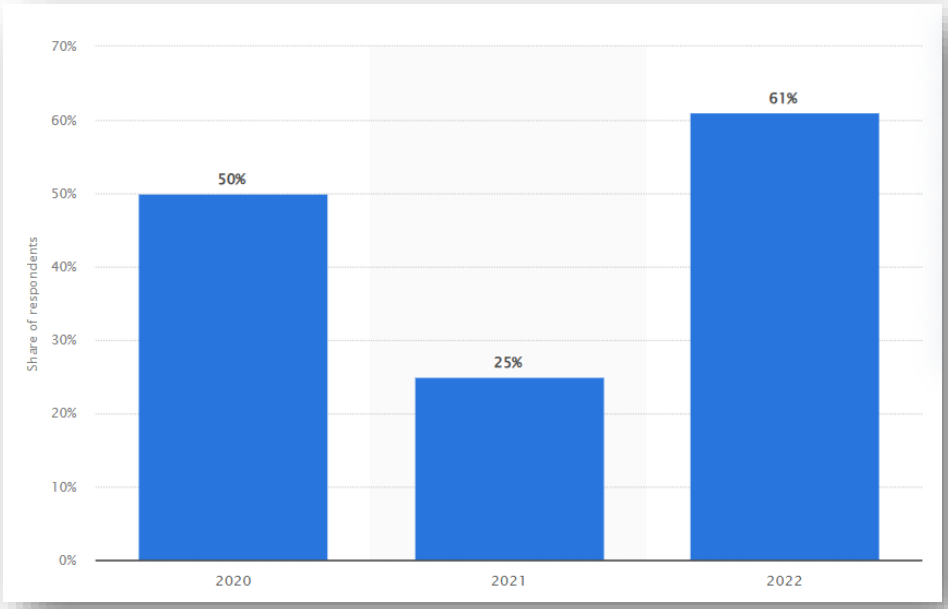


Figure 2.11.2: Adoption of QR Code in Malaysia

(Source: Statista, 2024)

Several major players have successfully driven the QR payment adoption in Malaysia. Efficient platforms such as GrabPay, Boost and "Touch 'n Go eWallet" Have achieved specific market share, providing incentives including discounts, seamless integration and cashback with retail services and public transport. The pandemic of COVID-19 accelerated this particular trend further as customers and businesses sought contactless solutions of payment for minimising their health risks (Modgil et al. 2022).

Besides such advancements, challenges exist to secure the white adoption among small businesses. Addressing such barriers needs rapid government support, enhanced technological infrastructure and targeted programs of financial literacy to make digital transactions easy in the society.

2.11.3 Case Study: Malaysia vs Singapore

A comparative discussion about Malaysia and Singapore QR payment applications reveals major insights regarding the success of digital payment. The "PayNow QR system" of Singapore has found a wide acceptance, with a more than 80% rate of penetration in businesses by the end of 2023 (Deloitte, 2020). The strong regulatory model of the nation and seamless digital infrastructure alongside a high rate of banking penetration have contributed towards the continuous integration about QR payments in several sectors.

In contrast, the penetration of QR payment in Malaysia among medium and small businesses stands at more than 65%, addressing a slower adoption than in Singapore. Multiple sectors contribute towards this gap, such as regulatory policies, efforts of business digitalization and differences across financial inclusion. While the nation has made specific progress with government incentives and DuitNow QR initiatives, future efforts are required to improve adoption among the small businesses.

2.12 2.12 The Psychological aspect of adopting QR Payment

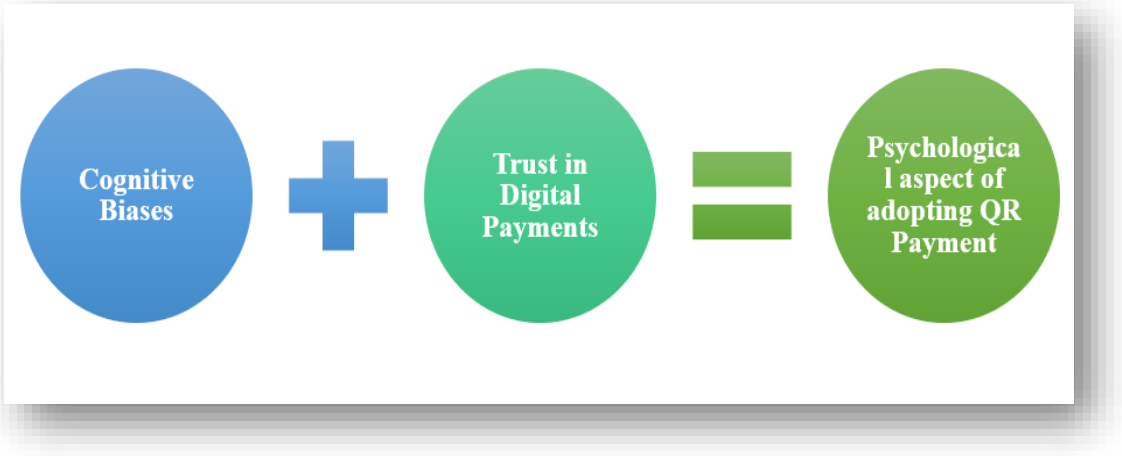


Figure 2.12: Psychological Aspects of QR Payments

(Source: Self-developed)

2.12.1 Cognitive Biases Affecting Adoption

The QR payment adoption has not been merely a concept of technical feasibility however, it is rooted deeply in psychological context, especially cognitive biases. Aversion of loss by Tversky and Kahneman plays a crucial role as how businesses and individuals perceive the systems of digital payment (Taylor et al. 2024). It suggests that individuals have a fear of loss more than anything, leading towards a hesitation to adopt modern financial technologies. It is significantly evident among medium and small businesses, that are sometimes risk averse because of the limited financial consequences.

According to PwC 2022, 68% of SMEs in Malaysia have been reluctant for adopting QR payment because of security reasons (PricewaterhouseCoopers, 2022). This fear has been aggravated by the high profile matters about data breaches, scams in digital payment and cyber fraud. Unlike large businesses, SMS sometimes lacks potential sources for implementing sophisticated measures of cyber security. As an outcome, several business owners efficiently perceive the digital payments Bing a proper liability.

Concerning the loss aversion, a bias in the status quo plays a pivotal role as well to hinder the adoption of QR payment. Bias in the status quo suggests the preference to maintain resisting change and existing systems, even when modern alternatives provide clear advantages. Several individual customers and SMEs have been accustomed to the traditional method of payment including card or cash transactions and can find it difficult further (Musyaffi et al. 2022). This bias has been strong, particularly across old businesses who have been dependent on the systems of conventional payment for so many times and are highly hesitant for adopting unfamiliar technologies.

Moreover, the endowment influence – where people overvalue what already they have, can reinforce the resistance to the adoption of QR payment. Several business owners investing in "the point of sale" systems, legacy banking and cash registers can feel reluctant for transitioning to the QR payments.

2.12.2 Trust in the Digital Payments

Trust has been a pivotal psychological factor affecting the adoption of QR payment, as all digital payments need users for placing confidence in financial and technological institutions. Loo et al. (2024), identified that trust across financial technology has been higher significantly among the young population, with 78% of the Gen Z Malaysians with prioritising QR payments, compared to less than 42% of the Baby Boomers. The generation gap addresses that familiarity along with digital platforms, online transaction comfort and exposure towards mobile banking contribute massive trust in the systems of QR payment.

The gap in trust between the old and young customers can be successfully attributed towards differences across digital literacy. Gen Z and Millennial customers, Having increased in this era of mobile and smartphone applications, are accustomed massively to utilising financial technology. More likely, they trust online banking and digital wallet systems, due to having regular involvement with subscription services, contactless transactions and ecommerce. Older generations and baby boomers, on the other hand, might be sceptical about digital payments because of the concerns regarding privacy, fraud and personal control lack over transactions (Cardoso et al. 2024).

Perceived reliability and security are critical factors as well affecting trust across QR payments. According to a research by Deloitte in 2023, 74% of customers trusting QR payments address measures of fraud prevention, protocols of user authentication and strong encryption (Deloitte, 2023). Conversely, those with distrusting QR payments sometimes address concerns regarding phishing attacks, fraud QR codes alongside unauthorised access towards the financial information. For financial services and businesses, building trust consists of addressing such concerns through applying robust measures of security.

Moreover, peer influence and social proof contribute to the trust across QR payments. Customers can adopt to the digital payments when they find wide use among their friends, family and peers. The QR payment adoption across popular retail businesses, systems of public transportation and cafes reinforces the legitimacy, making the hesitant users for trying them (Morrison et al. 2023). Regulatory support and government endorsement play a crucial role to build trust as well, as the financial authorities of the country can apply policies which secure system soft QR payment and adhere to transparency standards and higher security.

2.13 2.13. Perceived Consumer and unsuccessful trust

In this digital ecosystem of payments, perceived consumer and unsuccessful trust play one of the major roles to determine the rates of adoption alongside long-term involvement. Customers love to adopt the methods of digital payment when identifying benefits, concerning efficiency, convenience and security (Sahi et al. 2021). Particularly, verification of real-time transactions has emerged being a crucial feature to secure trust alongside drive adoption. Moreover, retail businesses have experienced specific growth through exploiting the solutions of digital payment, especially QR-oriented transactions because of the security and easy usage.

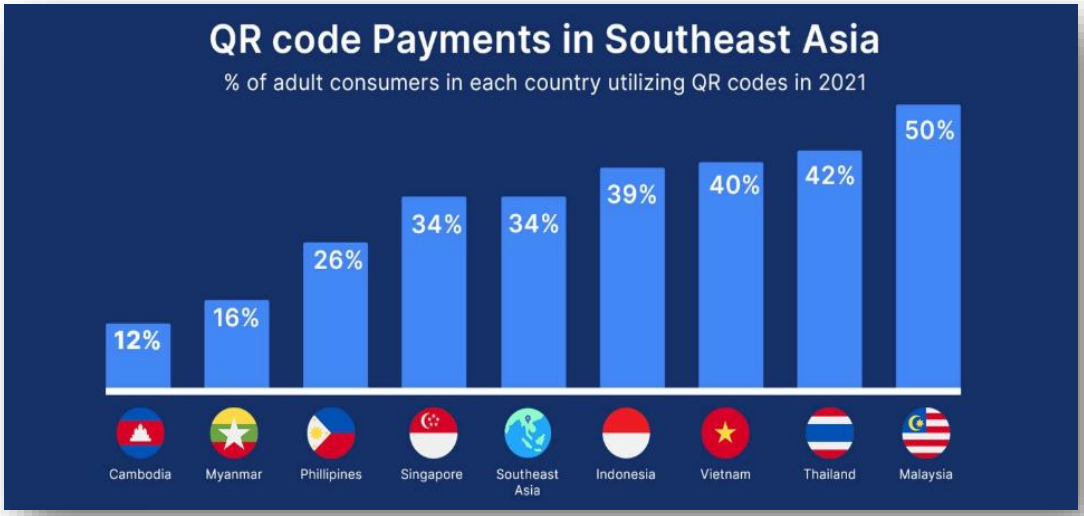


Figure 2.13: QR code payments in Southeast Asia

(Source: info @qrtiger.com, 2025)

2.13.1 Verification of Real-time Transactions

Verification of real-time transactions is a crucial feature that offers customers with quick confirmation about payments and cuts down anxiety aligned with the transaction. As per McKinsey 2023, almost 92% of the users of digital payment consider a real-time tracking as a pivotal factor when selecting payment platforms (McKinsey, 2023). It shows the requirement for immediacy and transparency across digital financial communications. Customers want quick feedback after making payments and want to ensure successful and secure transactions without errors or delays.

The real-time integration of transaction verification in business has influenced the digital wallet successes significantly. Touch ‘n Go eWallet in Malaysia witnessed more than a 30% surge across the volume of transactions concerning the features of real-time verification. This increase might be attributed for increasing customer confidence. Furthermore, businesses with acceptance to “Touch ‘n go eWallet payments” highly benefited from seamless transactions, pushing for a better customer experience alongside few disputes on failed payments.

Beyond Malaysia, different markets have successfully experienced the same trends. Across China, WeChat Pay and Alipay have set international standards, securing robust transactions during the peak periods of shopping (Sun & Rizaldy, 2023). The success about such platforms evaluates that customers love to use the methods of digital payments while they are highly assured about immediate verification, payment failures or cutting down fraud concerns.

Moreover, fintech companies and financial institutions have been exploiting real-time verification for combating fraud. Through incorporating machine learning and AI, payment providers will identify suspicious activities quickly, blocking the transactions before they have been processed (Rane et al. 2023). It improves customer trust, as the users feel properly assured about the production of their financial information.

2.13.2 Influence on the Retail SMEs

The influence about the adoption of digital payment on the SMEs has been so important, significantly in higher cash usage areas. Retailers across Malaysia reported a more than 40% increase across sales after the solution of QR payment integration (Alam et al. 2021). This growth is attributed largely to customer perception that the QR payments have been secure and convenient compared to the traditional transactions of cash.

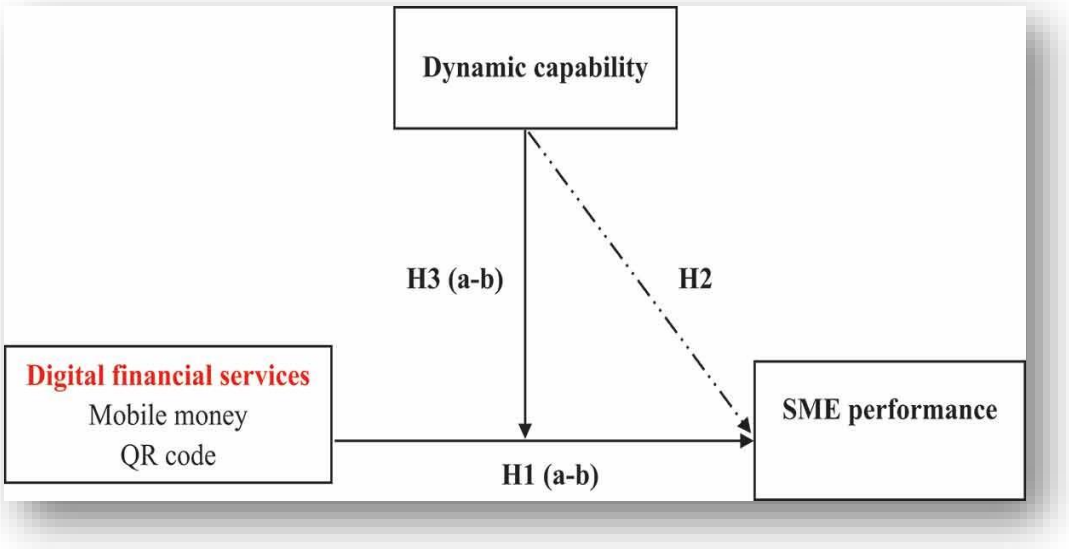


Figure 2.13.2: Influence of QR Payments on SMEs

(Source: Klenam Korbla Ledi et al., 2023)

QR payments efficiently eliminate the requirement of exact change, successfully making transactions more efficient and faster. For small businesses, it translates into the short time of checkout alongside the capacity for catering to more customers within time (Klenam Korbla Ledi et al., 2023). Furthermore, QR payments efficiently reduce the hurdles aligned with large cash handling, including mismanagement or theft.

Beyond the operational efficiency, the adoption of QR payment has improved customer trust as well across local businesses. While consumers perceive that any business provides modern and secure payment options, they can recommend it towards others. Trust is crucial, particularly after the pandemic, Where touchless transactions are preferred. By adopting the digital payments, small enterprises serve for the evolving customer preferences and at the same time relate themselves with international payment trends.

Another major factor driving the adoption of QR payment among small businesses has been the lower cost of transactions compared to the fees of credit cards (Soormo et al. 2024). Unlike traditional systems, QR payments sometimes need minimal investment, to make the solution cost-effective for small enterprises. With increasing initiatives of the government alongside fintech support, several SMEs have been expected for integrating the solutions of digital payment.

2.14 2.14. Financial Literacy's role in adopting QR Payments

2.14.1 Digital payment and financial literacy awareness

Financial literacy in business plays a major role to adopting the methods of digital payment, especially QR payments that have achieved specific traction over the years. As per the "Bank Negara Malaysia", more than 47% of people across Malaysia lack adequate financial literacy that affects their confidence and ability directly to use the systems of QR payment (Bnm.gov, 2023b). Several individuals, particularly the people with rural backgrounds and lower income struggle with initial concepts of finance suggesting digital banking, cashless transactions and budgeting. This gap in knowledge creates reluctance and hesitation to involve with the technologies of QR payment.

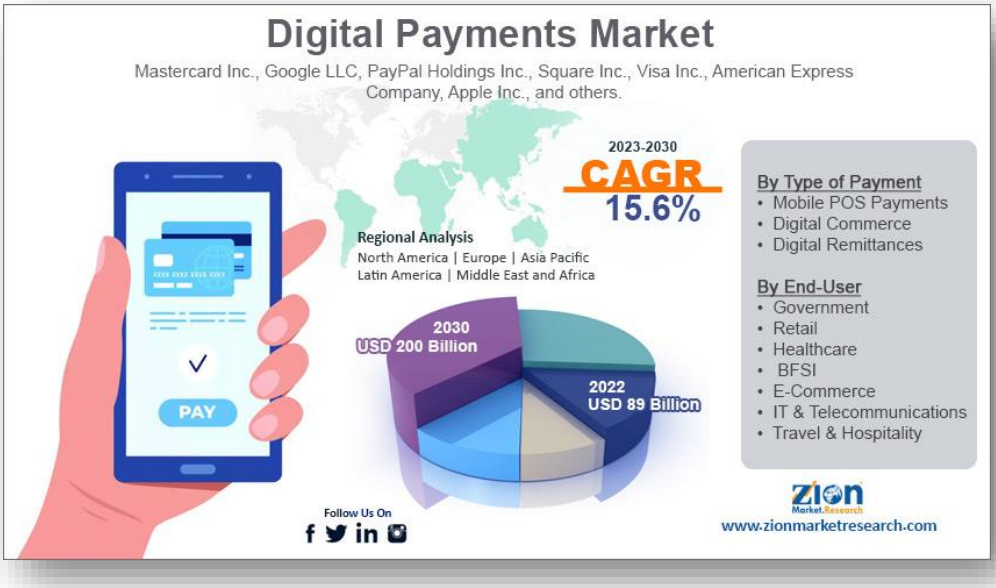


Figure 2.14.1: Market of Digital Payment globally

(Source: Zionmarketresearch, 2023)

Financial literacy lack affects the ability of an individual to use the digital payments however, it promotes misconceptions regarding transaction fees, measures of fraud prevention and security risks. Several Malaysians, especially who are unfamiliar with cashless transactions and online banking, fear cyber threats and unauthorised deductions (Ladiqi et al. 2021). These concerns impact the wide acceptance about QR payments, particularly among elderly people.

To evaluate this issue, a targeted program of financial literacy has been applied for educating the public regarding the security features and benefits about digital payments. As an example, Finasia reported a campaign of financial literacy across the nation led by financial institutions and government agencies, resulted more than15% growth in the adoption of QR payments in rural regions.

Moreover, financial literacy suggests recognising the digital payments however it promotes a mindset, of embracing financial technology. Young generations, especially those having great exposure towards digital finance love to adopt the systems of QR payments (Pintér et al. 2021). However, Old people, especially those across rural regions, need additional support for understanding the QR payments. Providers of financial services and policymakers should continue investing across the awareness initiatives and education for bridging the gap in financial literacy and encourage broader adaptation about digital payments.

2.14.2 Comparative Study: Rural versus Urban Malaysia

A particular disparity stage between the adoption rates of QR payment in rural and urban areas in Malaysia. A research by Sapian, & Ismail, (2021) addresses that when 80% of the urban businesses across Selangor accept the systems of QR payment, less than 35% of the rural businesses have applied the technology. The gap might be attributed for multiple factors, suggesting levels of financial literacy and infrastructure development.

In urban regions, systems of digital payment have become a crucial norm because of the wide Internet access, well-established financial ecosystem and higher penetration rates of smartphones. Most urban customers are familiar with the e-wallets, digital transactions and online banking (Ramli, 2021). Moreover, urban businesses identify the cost benefits and efficiency of accepting the QR pivots, like reduced risks of cash handling.

Conversely, rural regions face specific challenges to adopt the technology of QR payment. A major barrier has been the financial education lack that leaves several customers and business owners unaware about how the system of QR payments works. Several rural businesses continue to depend on the traditional transactions of cash because of a combination about limited access to the Internet and concerns regarding transaction fees. Except for proper education and guidance, such businesses can struggle for integrating QR payments efficiently (Alam et al. 2021).

Infrastructure development plays a major role as well in this rural-urban divide. While crucial cities like Johor Bahru, Penang and Kuala Lumpur have massive 5G and 4G coverage, A few rural regions face issues of connectivity still. The insufficient stable services of the Internet discourage businesses to adopt QR payments Because the unreliable connectivity might lead for transaction failures.

To overcome this Particular gap, the financial institutions and the government of Malaysia have introduced several initiatives focused on enhancing the adoption of QR payment across rural regions. Efforts including subsidised plans for mobile data, government incentives to adopt digital payment and targeted programs of training for the rural entrepreneurs r applied for promoting cashless transactions (Roy & Kumar, 2021). Furthermore, fintech businesses have started establishing offline solutions of QR payment that enable transactions smooth without or without a week connectivity of the Internet.

2.15 2.15. Perceived ease about “Use and System” Interface Design

The success about the solutions of digital payment depends massively on the perceived is about interface design and use. A user-friendly, inclusive system promotes adoption among businesses and consumers, while a poorly designed or complex interface sometimes leads towards higher rates of abandonment (Runsewe et al. 2024). The role about user experience alongside user interface how to shape the adoption of digital payment is evident, particularly across markets where customers require seamless interactions.

2.15.1 UI/UX Design Effect on Adoption

Research by the “Harvard Business Review” addressed that more than 80% of people abandon financial implementations with poor design of the interface. This trend has been evident, particularly in the sector of digital payment, where users need frictionless and smooth transactions. The primary impression about the design of a payment platform, and navigation flow alongside transaction compliance significantly influences whether users can continue it or abandon that (Putrevu & Mertzanis, 2024).

GrabPay in Malaysia serves being a major example about how UI/UX Enhancements drive adoption. Primarily, several applications of digital payment need multiple steps to process payments efficiently. However, GrabPay successfully introduced a simple feature of QR scanning, reducing the required

numbers for completing a payment. This improvement pushed for 85% growth in the volume of transactions, addressing how streamlined enhancements of design can lead towards higher involvement. Furthermore, well-designed platforms of payment incorporate responsive layouts, real-time mechanisms of feedback and visual clarity. For instance, securing clear placements of buttons covers minimal delays in processing and straightforward messages of payment confirmation improve user confidence (Hoang, 2024).

2.15.2 Challenges of SME in Integration

Despite the increasing adoption about digital payments, SMEs face critical challenges while integrating the solutions of QR payment into the operations of their business. According to "The Malaysian SME Association", almost 60% of the aise means massively struggle would issues of system compatibility oil adopting the QR payments (Bakar et al., 2020). Several SMEs operate outdating POS systems that cannot integrate with the modern platforms of digital payment seamlessly. It leads to the inefficiencies of operation, raised frustrations for the business owners and manual efforts of reconciliation.

Another critical challenge has been the technical expertise and cost needed for integration. Similar to the large businesses with dedicated technical teams, SMS sometimes lack the sources required to maintain and configure the solutions of digital payment. Some businesses encounter difficulties to manage multiple platforms of payment, as alternative service providers can have unique technical requirements alongside processing fees (Putrevu & Mertzanis, 2024).

Moreover, customer trust plays one of the major roles across SME adoption. Several small businesses, especially in less tech-savvy or rural communities, face massive resistance from consumers who prefer typical cash transactions because of the concerns regarding transaction security of the digital platforms. It addresses the requirement for the providers of digital payment to offer fundamental support including integration assistance, incentives and educational programs to facilitate the transition.

2.16 Theoretical Frameworks Underpinning QR Payment Adoption

- **Technology Acceptance Model (TAM)**

  The Technology Acceptance Model (TAM), developed by Davis (1989), is one of the most widely utilized theories to elucidate the adoption of new technologies, including QR payments. TAM posits that Perceived Usefulness (PU) and Perceived Ease of Use (PEoU) are the primary determinants influencing users' attitudes toward technology adoption. Research indicates that when users perceive QR payments as enhancing transaction efficiency and reducing effort, their likelihood of adoption increases (Shankar & Datta, 2018). Additionally, the role of behavioral intention in shaping adoption patterns has been extensively validated across digital payment research (Venkatesh & Bala, 2008).

  Further studies have expanded TAM by incorporating external factors such as trust, risk perception, and digital literacy, which play a critical role in influencing QR payment adoption. Scholars argue that while PU and PEoU are fundamental, trust in financial security and perceptions of risk significantly mediate the adoption decision (Kim, Tao, Shin, & Kim, 2010). Moreover, the effort expectancy component, linked to ease of use, suggests that the availability of customer support and user-friendly interfaces can enhance adoption (Zhou, 2013).

- **Unified Theory of Acceptance and Use of Technology (UTAUT)**

  The Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), extends TAM by incorporating additional variables such as social influence, facilitating conditions, and performance expectancy. Research indicates that social norms and peer recommendations significantly influence QR payment adoption, particularly in collectivist cultures

where word-of-mouth marketing and community validation play crucial roles (Lai & Lee, 2020). Furthermore, facilitating conditions such as stable internet connectivity and merchant acceptance influence the ease with which users transition to QR payments (Zhou, 2013).

Recent empirical studies have found that financial incentives and perceived economic benefits can further enhance adoption within the UTAUT framework. For instance, promotions, cashback rewards, and discounts impact the adoption rates of QR payments, particularly among younger consumers who are highly responsive to financial benefits (Malaquias & Hwang, 2016). Additionally, UTAUT highlights the importance of habit formation, whereby repeated exposure to QR payments leads to long-term adoption (Venkatesh, Thong, & Xu, 2012).

- **Trust-Based Theories in QR Payment Adoption**

  Consumer trust is a pivotal factor in the adoption of financial technologies. The Trust-Based Adoption Model (Gefen, Karahanna, & Straub, 2003) posits that users are more likely to adopt digital payment solutions if they perceive them as secure, reliable, and regulated. QR payment adoption is particularly influenced by users' perceptions of security and privacy risks, with research indicating that perceived security threats deter adoption rates (Kim, Tao, Shin, & Kim, 2010). Trust-building mechanisms, such as fraud protection, two-factor authentication, and transparent data policies, are crucial for ensuring sustained user adoption (Beldad, de Jong, & Steehouder, 2010). Furthermore, the Perceived Risk Theory suggests that consumers assess financial, privacy, and operational risks prior to adopting QR payments. Studies demonstrate that users who have experienced fraud or cybersecurity breaches exhibit higher resistance to QR payment adoption (Pavlou & Gefen, 2004). Addressing these concerns through government regulations, consumer education programs, and enhanced security features can mitigate perceived risks and encourage wider adoption (Bank Negara Malaysia, 2021).

2.16.1 Drivers of QR Payment Adoption

- **Convenience and Transaction Efficiency**

  The principal driver of QR Payment Adoption (QPA) is transaction efficiency. Consumers demonstrate a preference for QR payments due to their ability to facilitate seamless, contactless, and real-time transactions (Dahlberg et al., 2015). Research indicates that QR payments eliminate the need for physical cash, thereby reducing wait times at checkout counters and enhancing transaction speeds for merchants (Lai, 2021). Furthermore, QR payments enable businesses to streamline operations, facilitating faster payment reconciliation and reducing reliance on manual bookkeeping (Venkatesh, Thong, & Xu, 2012).

  Studies also indicate that users of digital payment methods are more likely to make repeat purchases and increase their spending levels when transactions are characterized as fast and frictionless (Hasan, Shams, & Rahman, 2021). The simplicity of scanning a QR code, combined with immediate payment confirmation, enhances the user experience and strengthens the habit formation necessary for continued adoption. Moreover, research suggests that transaction speed is directly correlated with perceived usefulness (PU), a critical determinant in the Technology Acceptance Model (TAM) (Davis, 1989).

- **Security Perceptions and Risk Reduction**

  Security concerns rank among the preeminent factors influencing QR payment adoption. Although QR payments offer advantages such as encrypted transactions and fraud detection mechanisms, apprehensions regarding data breaches, phishing attacks, and identity theft hinder widespread adoption (Pavlou & Gefen, 2004). Studies suggest that consumers are more inclined to adopt QR payments

when platforms exhibit robust security frameworks, including biometric authentication and regulatory compliance (Kim et al., 2010). Furthermore, consumers assess QR payment security based on their prior experiences with online transactions. Individuals who have previously faced fraud or hacking incidents often show reluctance to trust new digital payment methods unless substantial security assurances are provided (Zhou, 2013). Regulatory interventions, such as government-backed payment authentication systems and consumer protection policies, can alleviate these concerns and enhance trust in QR payments (Bank Negara Malaysia, 2021).A study by Luo, Li, Zhang, and Shim (2010) found that perceived security positively influences trust and behavioral intention toward mobile payment adoption. This indicates that QR payment providers must prioritize the implementation of advanced encryption, multi-factor authentication, and fraud prevention strategies to foster widespread utilization. Additionally, transparency in data collection and user privacy policies cultivates greater trust and mitigates consumer apprehensions (Beldad, de Jong, & Steehouder, 2010).

- **Socio-Cultural Influences and Peer Effects**

  Research indicates that cultural and social influences play a crucial role in QPA. In highly digitalized societies, consumers are more inclined to adopt QR payments due to their exposure to fintech ecosystems and social endorsements (Zhou, 2013). In contrast, in markets where cash transactions remain dominant, trust in digital payments must be cultivated through awareness campaigns and regulatory assurances (Lai & Lee, 2020). Social influence is particularly significant in collectivist cultures, where family, friends, and community recommendations shape consumer behavior. A study by Shankar and Datta (2018) found that users are more likely to adopt QR payments if their peers, influencers, or trusted institutions endorse the technology. Word-of-mouth marketing and promotional strategies that leverage peer influence can, therefore, accelerate adoption in emerging markets. Moreover, financial literacy and technological awareness significantly affect QPA. Consumers with a greater understanding of digital finance and mobile payment security are more inclined to adopt new payment technologies. Educational campaigns aimed at increasing digital financial literacy, particularly in underserved regions, can help bridge this gap (Malaquias & Hwang, 2016).

- **Merchant and Business Adoption**

  Merchant adoption is another essential factor in driving QR payment penetration. When businesses integrate QR payment solutions, it enhances consumer trust and expands digital payment ecosystems. Research shows that small and medium-sized enterprises (SMEs) adopt QR payments when transaction fees are low, settlement times are quick, and regulatory compliance is straightforward (Malaquias & Hwang, 2016).Additionally, businesses are more likely to adopt QR payments if they observe clear financial benefits, such as reduced cash handling costs, lower risks of theft, and enhanced operational efficiency (Dahlberg et al., 2015). In certain markets, government incentives—including tax benefits for digital payment adoption and grants for SMEs implementing fintech solutions—have successfully increased merchant participation in QR payment ecosystems (Bank Negara Malaysia, 2021).

  The degree of merchant penetration within a region also affects consumer adoption. Consumers are more inclined to use QR payments if they are widely accepted across various retail sectors, including supermarkets, transportation services, and restaurants. Ensuring a universal and interoperable QR payment infrastructure can significantly drive adoption rates (Lai, 2021).

2.16.2 Barriers to QR Payment Adoption

Despite its potential, QR payment adoption encounters several challenges arising from technological, security, regulatory, and behavioral factors. Understanding these barriers elucidates the reasons for inconsistent adoption across various consumer segments and regions.

- **Technological Barriers:**
  A primary obstacle to QR payment adoption is limited smartphone penetration and unstable internet connectivity, particularly in rural or underserved areas (Zhou, 2013). Given that QR payments necessitate a functional smartphone and a stable internet connection, users in low-connectivity regions may experience difficulties conducting transactions. Furthermore, older smartphone models may lack the capability to support advanced QR scanning features, thereby further restricting adoption among certain demographics. Digital payment providers must address this challenge by enhancing mobile payment infrastructure and offering offline QR payment options for regions with inadequate internet access.
- **Security Concerns:**
  Cybersecurity risks, including phishing attacks, fraud, and identity theft, pose significant deterrents to QR payment adoption (Kim et al., 2010). Consumers often exhibit hesitancy toward adopting digital payments due to concerns regarding unauthorized transactions or hacking incidents. Research indicates that a lack of clear fraud protection measures adversely affects consumer trust, leading individuals to favor traditional cash or card-based payment methods (Pavlou & Gefen, 2004). To alleviate security concerns, QR payment providers must implement multi-factor authentication, real-time fraud detection, and encrypted transaction mechanisms to reassure users of the platform's security.
- **Regulatory Challenges:**
  Variations in digital payment regulations across jurisdictions contribute to uncertainty and reluctance in adoption (Bank Negara Malaysia, 2021). Inconsistent financial policies related to data privacy, transaction limits, and fintech compliance create barriers for both consumers and merchants in embracing QR payments. Additionally, financial institutions may impose transaction fees or withdrawal limits, which can discourage users from fully adopting QR-based payments. Policymakers must establish standardized regulations to facilitate a harmonized and interoperable digital payment ecosystem that benefits both businesses and consumers.
- **Consumer Habits:**
  The transition from cash-based transactions to digital payments is significantly influenced by consumer behavior and habit formation. Many users, particularly those in older demographics, are accustomed to using cash and may be reluctant to switch to QR payments due to a lack of familiarity, perceived complexity, or distrust of digital platforms (Dahlberg et al., 2015). Behavioral research suggests that consumers who perceive QR payments as requiring substantial effort are less likely to adopt them. Addressing these concerns necessitates financial literacy programs, user-friendly interfaces, and incentive-driven adoption strategies, such as cashback rewards and discounts, to promote habitual use of QR payments.

By addressing these key barriers, stakeholders—including fintech companies, policymakers, and merchants—can work toward fostering an environment that encourages greater QR payment adoption. Implementing solutions that enhance technological accessibility, security, regulatory clarity, and consumer

confidence will be essential in overcoming existing challenges and advancing toward a fully digital economy.

2.16.3 Implications for Research and Policy

- **Implications for Research**

Future research endeavors should focus on the following areas:

Cross-country comparisons: Varying regulatory environments influence QR Payment Adoption differently. Comparative analyses between developed and emerging economies can yield insights into effective practices for policy harmonization (Zhou, 2013). Countries with robust financial infrastructure are likely to exhibit distinct adoption behaviors compared to those where cash transactions remain predominant, thereby providing valuable lessons for the global standardization of digital payments.

Behavioral economics and psychological influences: Subsequent research should delve deeper into the psychological factors, such as risk aversion, trust formation, and financial confidence, that affect QR Payment Adoption (Kim et al., 2010). A comprehensive understanding of behavioral responses to incentives, security concerns, and user experience can assist fintech companies in devising strategies that align with consumer preferences.

Longitudinal studies on adoption trends: Investigating the evolution of QR Payment Adoption over time can provide critical insights into the factors contributing to sustained usage retention (Shankar & Datta, 2018). This research should explore how user experience, regulatory changes, and technological advancements influence ongoing adoption.

The role of financial incentives: It is essential for studies to analyze the impact of financial incentives, such as cashback offers, discounts, and tax benefits, on QR Payment Adoption (Malaquias & Hwang, 2016). Prior research suggests that younger consumers exhibit heightened responsiveness to monetary incentives, underscoring the necessity of understanding how such motivators differ across various age groups and socioeconomic backgrounds.

The impact of digital financial literacy: A critical area for further investigation lies in assessing how digital financial literacy influences QR Payment Adoption among diverse demographic groups (Lai & Lee, 2020). A significant number of consumers demonstrate hesitance in adopting digital payments due to inadequate comprehension of security measures, privacy protections, and mobile banking functionalities.

- **Implications for Policy**

Standardized QR Payment Frameworks: Governments should prioritize the establishment of unified regulations governing QR Payment Adoption to promote seamless interoperability among financial service providers (Bank Negara Malaysia, 2021). A standardized QR ecosystem will facilitate cross-border transactions, enhance merchant acceptance, and bolster user trust in digital payment systems.

Financial Literacy and Consumer Awareness Programs: Public education campaigns should be systematically implemented to enhance digital payment adoption among populations with limited technological proficiency. Research indicates that misinformation and a lack of trust in the security of digital payment systems significantly diminish adoption rates (Lai & Lee, 2020). It is imperative for governments and fintech providers to collaborate in developing training programs designed to bolster consumer confidence in QPA.

Strengthening Cybersecurity and Fraud Prevention: Enhancing fraud detection technologies, implementing biometric authentication, and introducing regulatory mandates for data protection will help alleviate consumer concerns regarding the security of QR payments (Pavlou & Gefen, 2004). Effective cybersecurity measures will not only safeguard consumers but also promote a more secure digital financial

ecosystem that encourages sustained adoption.

Incentivizing Small and Medium Enterprises (SMEs): Policymakers should provide incentives such as tax reductions and lowered transaction fees to stimulate the adoption of QR payment systems among SMEs (Malaquias & Hwang, 2016). Given that the adoption of QR payments is significantly influenced by merchant availability, fostering extensive business participation will facilitate overall adoption.

Sustainability and Digital Inclusion: It is essential for governments to ensure that QPA contributes to a financially inclusive and environmentally sustainable economy by prioritizing the integration of cashless transactions within rural and low-income communities. Initiatives aimed at providing digital tools and subsidies for smartphone accessibility can significantly enhance the availability of financial services to unbanked populations.

By addressing these research and policy implications, stakeholders—including fintech providers, regulators, and businesses—can work collaboratively toward fostering a secure, inclusive, and efficient QPA ecosystem that aligns with global financial trends.

Conclusion

The adoption of QR payments is influenced by various factors, including technological acceptance, security perceptions, social influence, and regulatory frameworks. By enhancing trust, security, and ease of use, businesses and policymakers can facilitate the widespread adoption of digital payment systems, thereby contributing to the transition toward a cashless society.

2.17 Research Gap

Despite increasing scholarly attention on digital payment adoption, several gaps persist in understanding the adoption of QR payment systems among retail small and medium enterprises (SMEs) in Malaysia. While electronic payment systems (EPS) have been widely studied, research has predominantly focused on general mobile payment solutions, often overlooking QR-based payment adoption as a distinct category with unique implications for SMEs (Kanapathipillai et al., 2024; Rosli et al., 2020). Additionally, Malaysia's diverse retail SME landscape necessitates region-specific studies that account for urban-rural differences, digital literacy levels, and sectoral adoption rates.

- **Limited Empirical Studies on QR Payment Adoption in Malaysian Retail SMEs**
  While digital payment systems have been extensively researched, there is a scarcity of empirical studies focusing specifically on QR payment adoption among retail SMEs in Malaysia. Existing studies tend to generalize findings across various digital payment methods (Yan et al., 2021), thereby failing to account for the unique operational characteristics of QR payment systems. QR payments offer low-cost implementation, interoperability, and user-driven transactions, which may yield different adoption dynamics compared to mobile wallets or card-based digital transactions (Ahmad & Asghar, 2020).
- **Insufficient Exploration of Technological Readiness and Infrastructure Challenges**
  Technological readiness, including the availability of necessary infrastructure and the digital literacy of SME owners and employees, plays a crucial role in the adoption of QR payment systems. However, there is limited research examining how these factors specifically affect Malaysian retail SMEs (Rosli et al., 2020). Studies that investigate the impact of SME size, business type, and geographic location on technological readiness are needed to develop effective interventions that enhance infrastructure support and financial technology literacy.

- **Lack of Focus on Consumer Behavior and Trust Issues**
  Consumer trust and behavior significantly influence the willingness to adopt QR payments. Research highlights that perceived security risks, trust in financial institutions, and consumer familiarity with digital payments shape QR payment adoption (Rafferty & Fajar, 2022). However, many studies fail to explore these factors within the context of Malaysian retail SMEs, where consumer trust may vary based on demographic factors, prior experiences with digital fraud, and exposure to financial literacy initiatives.
- **Limited Examination of Government and Merchant Support**
  Government-driven policies, such as Bank Negara Malaysia's DuitNow QR initiative, play a significant role in influencing QR Payment Adoption (QPA) among SMEs. However, there is limited research evaluating the effectiveness of these initiatives and whether they translate into long-term QPA (Kanapathipillai et al., 2024). Further studies should assess merchant support strategies, government incentives, and industry collaborations to ensure sustained QPA across Malaysia's retail sector.
- **Need for Comparative Studies Across Regions and Sectors**
  Many existing studies focus on individual case studies or specific urban settings, limiting the generalizability of findings across Malaysia's varied SME ecosystem. Comparative studies that examine regional adoption trends, rural-urban disparities, and sector-specific adoption challenges can provide a more holistic understanding of QPA among Malaysian retail SMEs (Yan et al., 2021).

Conclusion

Addressing these research gaps is essential for developing targeted strategies that facilitate the adoption of QR payment systems among Malaysian retail SMEs. Future research should emphasize empirical investigations into technological readiness, consumer trust, and government policies. Additionally, comparative studies can provide insights that inform policy interventions, SME support programs, and fintech innovations, ultimately contributing to Malaysia's digital payment transformation.

2.18 Conceptual Framework

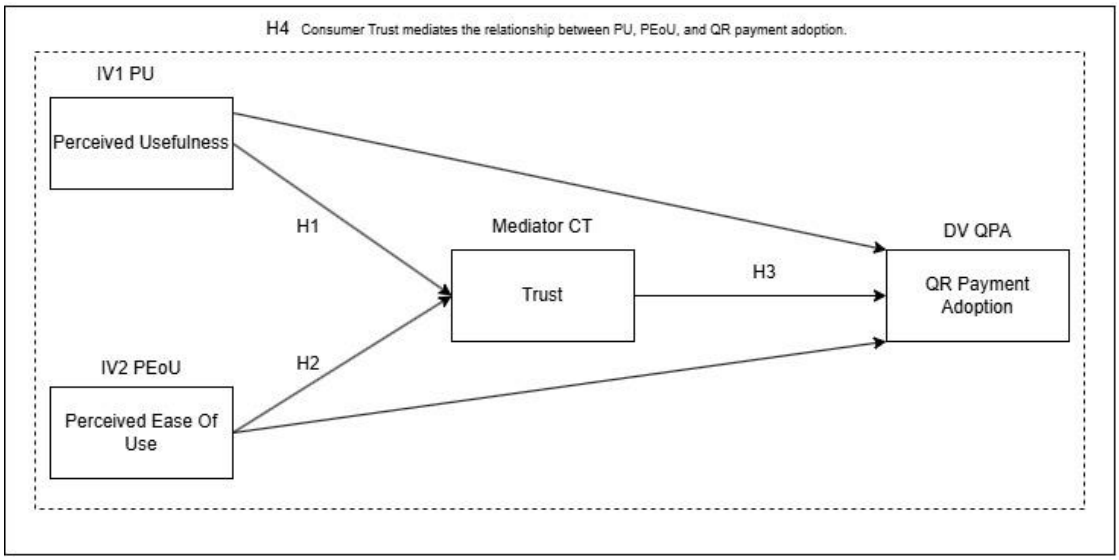


Figure 2.2: Conceptual Framework

This study uses a conceptual framework to look into the mediating part of consumer trust in the connection between how useful something is thought to be (PU), and how easy it's seen as being used (PEoU), with QR payment acceptance in Malaysia. The basis for this framework is Technology Acceptance Model

(TAM). It highlights PU and PEoU's role in influencing consumer trust, which then affects QR payment systems' adoption.

2.18.1 Dependent Variable

QR Payment Adoption (QPA): QR Payment Adoption expresses the readiness of consumers to employ QR payment methods for their transactions.

2.18.2 Variables

Perceived Usefulness (PU): The consumer's perception of how effectively QR payments will improve their transaction performance.

Components:

- **Effectiveness:** How well QR payments meet consumer needs and expectations.
- **Efficiency:** The speed and ease with which transactions can be completed using QR payments.
- **Adaptability:** This refers to how well QR payment systems can adjust and fit with different transaction situations and user needs.

Perceived Ease of Use (PEoU)

The extent to which a customer perceives that making QR payments will be without any difficulties or complexities.

Components:

- **User Experience:** The general contentment with the user interface and ease of use of QR payment systems.
- **Accessibility:** The availability and ease of access to QR payment systems.
- **User Friendliness:** The simplicity and intuitiveness of using QR payment systems.

2.18.3 Mediator

Consumer Trust (CU): The trust of users in the dependability, safety, and speediness of QR payment methods.

Components:

- **Reliability:** This deals with the steadiness in finishing QR payment transactions, making sure that all processes are done correctly and on schedule.
- **Security:** The safety of customer data and transaction accuracy in QR payments, making sure that personal details and financial information remain protected.
- **Responsiveness:** QR payment systems should be responsive. It means they can solve problems and answer questions quickly, giving users fast and good help.

2.18.4 Hypotheses

The suggested hypotheses are:

H1 : Increased levels of PU positively affect Consumer Trust.
H2 : Increased levels of PEoU positively affect Consumer Trust.
H3 : Increased levels of Consumer Trust influence more QR payment adoption.
H4 : Consumer Trust mediates the relationship between PU, PEoU, and QR payment adoption.

2.18.5 Hypothesis Development

i. Hypothesis 1: Increased levels of PU positively affect Consumer Trust

Usefulness perception, which is also known as Perceived Usefulness (PU), implies the consumer's belief that applying a certain system will boost his or her performance. In terms of QR payment systems, PU could be seen as how much the consumers think using these payments will better their transaction speed and success. Trust in technology is always shown to be predicted by PU. As people start to find technology

useful, their trust in the system grows and this boosts its adoption rates (Davis,1989; Venkatesh & Davis, 2000).

For example, in the study by Kim et al. (2009), it was discovered that perceived usefulness has a significant effect on consumer trust towards online banking systems. This link is rooted in the perception that when users see a system as beneficial, they tend to have more trust in it. Likewise, when consumers have a belief that QR payments are quicker and simpler, this will increase their trust in these systems. Trust then aids the acceptance of QR payments (Gefen et al., 2003).

Therefore, the first hypothesis is formulated as follows:

H1: Increased levels of perceived usefulness positively affect consumer trust.

ii. Hypothesis 2: Increased levels of PEoU positively affect Consumer Trust

Perceived ease of use (PEoU) is a person's belief that using a certain system will require no effort. In relation to QR payments, PEoU can be understood as how much consumers find it easy to understand and use QR payment systems. According to research, perceived ease of use is an important element in establishing trust toward technology among consumers. Consumers who perceive technology as being easy to use will likely show more trust in it and adopt the new technology (Venkatesh & Bala, 2008).

In a study done by Gefen et al. (2003), it was shown that ease of use has a big impact on trust in e-commerce situations. They argued that when users see a system as simple to move around and understand, their belief in its dependability and safety gets stronger. This trust is important for technological acceptance, specifically in online and mobile payment systems. If QR payment systems are easy to use with clear interfaces and straightforward steps, consumers will probably trust and adopt these systems more.

For instance, a study from Pavlou (2003) pointed out that PEoU has a direct effect on consumer trust in electronic marketplaces. In the same way for QR payments too, if the systems are simple and easy to use then it will make consumers trust these systems more which can increase adoption of QR payments.

Therefore, the second hypothesis is formulated as follows:

H2: Increased levels of perceived ease of use positively affect consumer trust.

iii. Hypothesis 3: Increased levels of Consumer Trust influence more QR payment adoption

Trust from consumers is very important for new technologies to be accepted, and this includes systems of payment online or on mobile devices. Trust in QR payments means you believe the system will work well, keep your information safe and respond quickly. When people have trust in a payment system, they are inclined to use it for their transactions.

Studies have proven that consumer faith greatly affects technology adoption. A notable example is the work of McKnight et al. (2002) who stressed how trust forms a key factor in determining whether consumers accept e-commerce or not. Trust makes people feel less risk when they try new technologies, so they become more ready to use them. If users have trust in QR payments that it can keep their personal and money details safe, as well as handle transactions effectively - this will encourage adoption and usage of QR payments (Pavlou & Fygenson, 2006).

Moreover, research conducted by Kim et al. (2009) found that trust has a direct effect on the acceptance of online banking systems. We can extend this outcome to QR payment systems as well; trust is significant in consumers choosing to utilize the technology. For the clients, if they really trust the QR payment systems, it will become easier for them to accept and use these ways in their dealings.

Therefore, the third hypothesis is formulated as follows:

H3: Increased levels of consumer trust influence more QR payment adoption.

iv. Hypothesis 4: Consumer Trust mediates the relationship between PU, PEoU, and QR payment adoption

The trust of consumers is not just a result of how useful and easy it is to use, but also something that mediates the relationship between these factors and technology adoption. This mediation means that PU and PEoU indirectly impact QR payment acceptance by affecting the trust people have in this system.

The role of trust in technology adoption models has been confirmed by research. For example, Gefen et al. (2003) discovered that trust mediates the impacts of PU and PEoU on accepting e-commerce systems. This mediation implies that the real adoption behavior of consumers, even when they see a system as beneficial and simple to use, is greatly affected by how much trust they have in it.

For QR payments, the trust of consumer is like a connection between PU, PEoU and adoption behavior. When people see QR payments as useful and simple to use, their faith in the system grows. This trust leads them to choose QR payments. A study from Pavlou and Fygenson (2006) emphasized that trust is an important mediator in using electronic services. This supports the notion of trust being a critical intermediary variable.

Therefore, the fourth hypothesis is formulated as follows:

H4: The link between perceived usefulness, perceived ease of use, and QR payment adoption is moderated by consumer trust.

2.19 Conclusion and Summary

Hence, this chapter discusses a literature review of QR payment adoption, including the theoretical contributions, existing studies, and research agendas of the area. In this chapter, such goals are accomplished successfully through analyzing existing literature and identifying research gaps, which in turn contributes to enhanced understanding of the factors that influence users' perception and utilization of QR code payment system. This provided the theoretical context into the subsequent theoretical model of technology acceptance that stated that perceived usefulness, perceived ease of use, and consumer trust are some of the factors that determine a user's intention to use QR payment technologies. For this reason, in this chapter, the author presented the conceptualization of a QR payment, and its adoption based on the theoretical frameworks belonging to the fields of information systems, economics, sociology, psychology, and marketing.

Then the chapter highlighted on perceived usefulness and perceived ease of use, which stressed the fact that the two fundamental beliefs that users have over the effectiveness, convenience, and ease of using a certain technology can greatly determine their adoption behavior. It also discussed consumer trust where people should know that they are safe when paying through the QR since trust is crucial in enhancing confidence, reliability, and security of the QR payment systems. In addition, this chapter discussed the factors critical in determining QR payment adoption and also offered ideas on technological, social, economic, and institutional factors affecting adoption behavior. The study also explained the effect of contextual factors such as compatibility, ease of use, cost, and government support in explaining the willingness of users towards adopting QR code-based payment system. Furthermore, the chapter revealed the possible questionings and advancements for the subsequent studies regarding the QR payment adoption. It urged for more research to be conducted regarding the various moderating factors or factors of influence that relate to adoption behavior among other populations, geographical regions and various economic systems. It also highlighted the lock in tackling, marketing factors, security, and socioeconomic factors, regarding the choice of QR payment acceptance and financial integration.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

The research methodology chapter serves as the foundation of this study, establishing the structured framework that ensures a systematic, objective, and demanding approach to answering the research questions. This study examines the mediating role of trust in QR payment adoption among retail SMEs in Selangor, Malaysia, necessitating a methodologically sound approach to enhance the validity and reliability of the findings. This chapter begins by outlining the research design and methodological choices, followed by an explanation of the research approach and paradigm adopted. It then details the data collection techniques, sampling strategies, and analytical tools utilized in the study. Furthermore, aspects such as measurement model evaluation, hypothesis testing, mediation analysis, pilot testing, and ethical considerations are discussed to ensure academic rigor in the research process. The ultimate objective is to provide empirical evidence through a structured quantitative approach that can offer generalizable and practical insights for stakeholders in the retail SME sector. The methodological framework is carefully structured to allow for a comprehensive examination of the relationships between Perceived Usefulness (PU), Perceived Ease of Use (PEoU), trust, and QR payment adoption. A quantitative approach using Structural Equation Modeling (SEM) with Partial Least Squares (PLS) is employed to enable the testing of complex models, including direct and indirect effects between the studied variables. This methodological choice ensures that the analysis captures the nuances of trust as a mediating factor, offering a robust foundation for theoretical and practical contributions.

A well-structured research methodology enhances the credibility and applicability of findings. This chapter ensures that every methodological decision aligns with the study's objectives, ensuring that the research process is transparent, replicable, and methodologically sound. The subsequent sections provide a detailed explanation of the research design, data collection strategy, and analytical techniques employed in this study to investigate QR payment adoption among retail SMEs in Malaysia.

3.2 Research Design Overview

Research design refers to the plan identifying procedures and methods to be carried out in a given study. Research design frames the support structure for collecting, measuring, and analyzing data. This paper adopts a cross-sectional and quantitative research design to establish the mediating role of trust in QR payment adoption among SMEs in Selangor, Malaysia.

Cross-Sectional Design: A cross-sectional design implies that data are collected only once from a sample at a singular point in time. The cross-sectional design is chosen because it offers an economic means to grasp the existing state of QR payment adoption among SMEs in the retail sector. Such a design also enables the researcher to simultaneously estimate the relationships between perceived usefulness (PU), perceived ease of use (PEoU), trust and QR payment adoption simultaneously. The cross-sectional nature of this study captures the momentary attitude/behavior of the SMEs with respect to the QR payment system. It is important to serve as a foundation for realizing the variables affecting adoption.

Quantitative Research Approach: In this study, the adopted quantitative approach will be used to objectively measure variables and test defined hypotheses by employing statistical methods. The quantitative approach is appropriate when analyzing the relationship among a number of variables and when generalizing study findings to a wider population. Structured questionnaires assist in obtaining systematic numeric data, which can then be studied for patterns and relationships. The quantitative method

ensures the reliability and validity of the results, which in turn provides a concrete foundation for justified conclusions.

Structural Equation Modeling (SEM) and Partial Least Squares (PLS): SEM is a multivariate statistical analysis technique based on measurement theory. Although there are significant advances, SEM-PLS is ideally suited for research designs in which the theoretical framework is still in its infancy. The PLS research design refers to statistical techniques that have been used to examine the connection of dependent variables with multiple independent variables. This also helps in identifying the relationships and impact of the mediating variables and grasping the most substantial covariance between them (Purwanto & Sudargini, 2021). Also, with the help of PLS design, this research study can understand the influence of the mediating variables on the dependent variables specifically when examining complicated relationships using SEM standards. This study has adopted PLS-SEM as it allows complex models with multiple constructs and indicators to be tested empirically, even with relatively smaller sample sizes.

Justification for the use of SEM and PLS: This research will be conducted using the SEM-PLS method with the following justification:

a. being exploratory, the study has to explore the mediating role of trust in the adoption of QR payments, as theoretically this concept is at the very emergent stage.
b. The research design of this paper is developed based on multiple constructs and their relationships. In that case, SEM-PLS has the capacity to handle the model efficiently and is able to provide reliable estimates of the relationships.
c. This research design allows for the validity and reliability checking of the constructs and significantly tests the relates between the independent and dependent variables via the mediator (trust).

Justification for tools used:

a. PLS-SEM requires less sample size compared to covariance-based SEM. In this study, the allocation is to achieve a minimum sample size of 200 respondents.
b. The prime objective of this study is to predict the dependent constructs, and under such circumstances, the PLS-SEM method is focused on maximizing the explained variance of the endogenous variable.

Software for PLS-SEM: SmartPLS is the most adopted software application in PLS-SEM. It has the user interface and an advanced solution to check the measurement and structural models. This has the construct reliability and validity tool of Cronbach's alpha, CR, and AVE. Furthermore, it also facilitates the calculation of path coefficients as well as the significance levels through the application of the bootstrapping technique, which is a non-parametric resampling procedure used for determining intervals to verify confidence of hypothesis.

Data Collection: This approach primarily involves distributing a structured questionnaire to an SME sample in Selangor. A structured questionnaire developed to gather data on perceived usefulness, perceived ease of use, trust, and QR payment adoption. Choosing the online survey approach was viable based on its effectiveness that can facilitate access to more respondents than other methods. The target population will be SMEs who have adopted QR payment systems, whereas the sampling technique will involve stratified random sampling to ensure that it is representative.

Survey Instrument: The questionnaire consists of numerous Likert-scale items rated from 1 (strongly disagree) to 5 (strongly agree). To ensure validity and reliability, items are adopted from the literature from established scales. A pre-test cutoff size of the questionnaire has been conducted on a small sample to identify apparent issues and, where possible, fix them before the real data collection.

3.3 Research Approach and Paradigm

The research approach and paradigm define the philosophical basis from which the study is conducted in selecting a method and techniques concerning the data collection and analysis. This paper adopts a quantitative research approach within a positivist paradigm because the objective of the study is to investigate the mediating role of trust in QR payment adoption among SMEs in Selangor retail sector, Malaysia.

Research Paradigm: Positivism The underlying or overarching philosophical paradigm of the study is positivism. Positivism assumes that reality is objective and can be measured and quantified empirically. Positivism underlies the use of scientific methods and statistical analysis in the testing of hypotheses and drawing of conclusions. The broad significant features of positivism, as consistent in the study, are hereby stated as follows:

Objective Reality: Positivism assumes that phenomena can be observed and measured objectively. Seeing that this study measures SME perceptions and behavioral dispositions about QR payment adoption, the structured questionnaires are used.

Empirical Evidence: Positivism founds knowledge on empirical evidence derived from the systematic collection of data. The use of quantitative methods and the subsequent statistical analysis present objective and replicable results.

Hypothesis Testing: Positivism places an empirical emphasis on hypothesis testing using statistical methods. This study will test hypotheses regarding the relationships between perceived usefulness, perceived ease of use, trust, and QR payment adoption.

Generalizability: The purpose of positivist research is to provide findings that can be generalized to a population. Findings of this study will ensure that with stratified random sampling and a sufficiently large sample, the sample findings are generalizable to the SMEs in Selangor.

Justification of Approach and Paradigm: A suitable paradigm for the research is the quantitative approach and the positivist paradigm. The major reason for using the quantitative approach and positivist paradigm is that they yield objective, reliable, and generalizable findings. The quantitative approach is appealing to the study, and the positivist paradigm will be embraced due to the structured and systematic nature of collecting data which are consistent and comparable, making it possible to draw significant relationships between variables.

The quantitative approach and a positivist paradigm are also appealing for this paper, as it will contribute to enhancing what is known about QR payment adoption among SMEs in Selangor, Malaysia, for a systematic and in-depth understanding of its use and mediating effect of the trust. The procedures used are systematic and rigorous, while the method rests on an extremely large ground to build the research with the analysis and interpretation of data. Based on this argument, the quantitative research approach and a positivist paradigm provide a proper ground to analyze the mediating effect of the trust in supporting the QR payment adoption. The reason is that there is objective measurement of different variables used in the research, and the findings are reliable and generalizable, thus adding insight to the digital payment adoption process.

3.4 Data Collection and Sampling Technique

3.4.1 Data Collection Methods

The data collection method in the research study is crucial to ensure the reliability, accuracy, and quality of the research study. As this study adheres to the quantitative approach, proper method adoption for data

collection influences the wisdom stems from the trustworthy and valid analysis. This further allows for informed decision-making for the SMEs based on practical evidence instead of depending on assumptions and contributes to bias minimization and impactful business strategies. In this regard, the main data collection method shall be through a structured questionnaire sent to the respondents. A questionnaire is ideal for this research as it shall accurately obtain all the data relevant to the study regarding perceived usefulness, perceived ease of use, trust, and adoption of QR payment (Pontoh et al., 2022). The structured questionnaire will ensure that the collected data is uniform, consistent, and will provide for comparability of data between the respondents.

3.4.2 Survey Design

Different sections of the structured questionnaire have questions that reflect all aspects of each construct: demographic information, perceived usefulness, perceived ease of use, trust, and QR payment adoption. The questions incorporated within the questionnaire were generated from established questions available in the literature, as a strategy to maintain the validity and reliability of the measures employed.

Demographic Information: This will include basic information on the age, gender, education level, type of business, and number of years of operation. These demographic variables will help us to understand the background of respondents and also to identify the patterns and possible relationships between the demographics and the adoption of QR payment. These demographic factors further help to understand the behavior, intentions, and attentions of the population towards the adoption and usage of QR payment methods.

Perceived Usefulness: This section consists of items related to how much the respondents believe that using QR payments adds to the performance of their business. The questions based on the TAM include such questions as "Using QR payments improves the efficiency of my business operations."

Perceived Ease of Use: This section consists of items on the difficulty the respondents will anticipate while using QR systems. Included is such an item as "Learning to operate QR payments is easy for me." Thus, reflecting the perceptions of the respondents on the user-friendliness of the system.

Trust: This section measures the level of trust respondents have in QR payment systems, including aspects such as security, reliability, and integrity. Items include "I trust QR payments to be secure for financial transactions."

QR Payment Adoption: This section captures the respondents' actual usage and intentions to use QR payments. Items include "I use QR payments frequently in my business transactions" and "I will continue using QR payments in the future."

3.4.3 Sampling Techniques

The population sample is retail SMEs in Selangor. The sampling method is stratified random sampling to adequately sample the overall population of retail SMEs in Selangor. The main characteristic of this sampling technique is that it apprehends the key characteristics of the population within the sample. Therefore, it significantly confirms that the subgroups in the sample populations are represented proportionally (qualtrics.com, 2025). This leads to more accurate and reliable outcomes by decreasing possible biases and displaying a sounder reflection on the prevailing population. There is a difference in the operational scale of businesses and the retail subsector; stratified sampling ensures proportional representation of micro, small and medium enterprises that fall within the retail population. This will allow for valid results as each smaller subdivision of the larger population of retail SMEs will be adequately represented. A stratified approach is justified because the retail SMEs differ in revenue, retail products and

operating services as well as their use of QR payment systems. This lowers sampling bias and enhances generalizability as the sample includes all types of retail: clothing, electronics, food, etc.

3.4.4 Target Population

The target population for this study consists of retail Small and Medium Enterprises (SMEs) in Selangor, Malaysia, a critical segment of the country's digital economy. Retail SMEs are selected due to their pivotal role in Malaysia's economic framework, comprising 97.4% of all business establishments and contributing significantly to the nation's gross domestic product (GDP) (Department of Statistics Malaysia, 2023). In 2022, around 84.4 per cent of all the small, micro, and medium-sized enterprises in Malaysia function within the retail and wholesale trade sector as this is the most common industry across the ASEAN nations (statista.com, 2022). In addition, in the same year, Selangor recorded that about 109,507 SMEs within the retail trade and wholesale actor account for nearly 47.2% of the entire establishment within this state of the country (dosm.gov.my, 2024). Selangor is chosen as the study's focal region due to its high economic activity, advanced digital infrastructure, and significant adoption of digital payment solutions, making it an ideal setting for examining QR payment adoption trends. According to the latest reports from the Malaysian SME Corporation (2023), the total number of registered retail SMEs in Selangor is 109,507. This total population serves as the basis for sample size calculation to ensure statistical validity and generalizability of the findings.

Sample Size Calculation:

To determine a statistically reliable and representative sample, this study applies Yamane's (1967) formula, a well-established method for estimating sample sizes in large, known populations. Yamane's formula is expressed as follows:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}(\mathrm{e}^2)}$$

Where:

- N = 109, 507 (population size of retail SMEs in Selangor)
- e = 0.05 (margin of error)

$$n = \frac{109,507}{1 + 109,507(0.0025)} \approx 398$$

Yamane (1967) introduced this formula as a practical approach to sample size determination, particularly for large populations where a census is impractical. It is widely used in social science and business research because:

1. It is suitable for large finite populations (such as retail SMEs in Selangor).
2. It provides an optimal balance between precision and practicality, ensuring a representative sample without excessive data collection.
3. It prevents under-sampling or over-sampling, making it ideal for survey-based research.
4. It ensures an adequate confidence level (95%), allowing the findings to be generalizable within the population.

While alternative sample size determination methods exist, such as Krejcie & Morgan's (1970) Table, Cochran's (1977) Formula, and Power Analysis (using G*Power software), Yamane's approach is deemed most suitable for this study due to its efficiency, ease of application, and suitability for large, known populations. Therefore, a sample size of approximately 398 retail SMEs is deemed appropriate to achieve a 95% confidence level and ensure statistical robustness. This sample size balances accuracy with feasibility, acknowledging potential resource constraints and response rates. The sample will cover a range of retail businesses across Selangor to reflect varying levels of QR payment adoption, thus providing comprehensive insights into the factors driving or hindering the adoption of QR payment systems among retail SMEs. By integrating target population and sample size determination, this study ensures that its methodology is statistically sound, practically feasible, and representative of the retail SME sector in Selangor. The application of Yamane's (1967) formula confirms that a sample of 398 SMEs is sufficient to achieve robust and generalizable results, while a stratified sampling approach enhances representativeness. This methodological rigor strengthens the study's contributions to understanding QR payment adoption and trust dynamics within Malaysia's evolving digital economy.

3.4.5 Procedure for Data Collection

This action will be carried out by using online survey forms to send questionnaires directly to respondents. Some questionnaires will also be given out physically. Integrating survey forms as tools for data collection in the context of the study is valid and justified due to its several advantages. The collection of the data using a survey is aligned with the effective questionaries that are intended to measure. This further allows orientation with the specific concepts of this research study while ensuring accurate meaningful data insights. Surveys that are done online have been called both effective and cheap because they can reach lots of people in a very short time.

Steps to follow include:

Survey Distribution: The set of questions will be sent out by email to the SMEs sample selected or through invitation links given out via personal contacts, as per what is easier. Some questionnaires will also be handed over directly. They are distributed together with a personal message that explains about this research study and points towards one link where online surveys can be filled in. It would also be confirmed that all the answers given in the survey were anonymous and kept confidential.

Reminders: For handling an increased response rate, reminders are dispatched to those who have not responded after one week or two weeks through emails.

Data Collection Period: The period for collecting data is eight weeks. It allows enough time for respondents to finish the survey and gather the data.

Ethical Thoughts: The data gathering activity is completely ready for all ethical thoughts. It's confirmed that people giving responses have agreed to participate and they know well about the study's nature, their role as a respondent, and how their data will be used. Every respondent gets assured that his/her responses won't get disclosed to any other respondent, but it is only available for researchers. This study adheres to the ethical standards set by the Institutional Review Board of the university. Survey creators adhere to relevant data protection regulations and laws which ensure that the personal information of the respondents is securely gathered, kept, and employed just for the pinpointed purposes (Capili & Anastasi, 2024). This not only ensures data security but also protects sensitive data and avoids potential bias. Furthermore, clear communication regarding the goals and benefits of the study reduces the potential harm and risks to the participants.

Data cleaning and preparing: This is the procedure of changing data, which has been collected to clean it up, into high-quality data for further analysis.
Screening of Incomplete Responses: Incomplete data will be accounted for, identifying questionnaires that have missing questions or those with some information in their questionnaire remaining incomplete and segregating them from the dataset.
Identifying Outliers: The identification process of outliers uses a particular statistical method. If the data is seen as contaminated, then these outliers will be adjusted for and eliminated.
Consistency Checking: Analyzing to check how consistent the answers are, suggesting that there should be logical and coherent flow in all parts of the questionnaire.
In general, the ways of collecting data and sampling in this research appear to be methodical and careful. The use of a structured questionnaire, stratified random sampling, and online survey method seem to offer the best way for gathering high-quality secondary data. Extra trust in the reliability and validity of the data - thus ensuring that findings from this research are precise as well as can be applied broadly - is provided by additional steps like cleaning up collected information plus considering ethics aspects too. Overall, these ensure that the collected data are appropriate for analysis and have contributed to the overall outcome of the research study to gain insight into the constructs.

3.5 Data Analysis Tools

The data analysis tools, like SmartPLS software, are key for dealing with and understanding the gathered data. The main tool we used in this study is SmartPLS software which has been made particularly to carry out Partial Least Squares Structural Equation Modeling (PLS-SEM).

3.5.1 SmartPLS Software

Partial Least Squares Structural Equation Modeling is the name of the software-SmartPLS. This software allows the researcher to evaluate a measurement and structural model holistically, from evaluating construct reliability and validity to evaluating the relationships between latent variables. SmartPLS is intended to assess complex models that traditional covariance-based SEM would not be able to accurately assess. It is ideal for the exploratory assessment of data and for prediction. SPSS is employed early in the collection process and with preliminary statistics. SPSS will be used for data entry, reliability, and t-tests to check for accuracy, reliability, and missing cases, which is nice to ensure proper data cleaning and no issues before uploading into SmartPLS. There is comfort in results when SPSS and SmartPLS are involved. Where SPSS only generates rudimentary statistical results, SmartPLS uses those results and conducts an array of tests on the measurement model and the structural model. These two models allow for a full possibility of testing and certainty of reliability and validity. Results are tested in a tiered fashion and inclusively test and appropriately test all results.

3.5.2 Justification for Chosen Tools

SmartPLS was selected because it assesses complex models and can be used for confirmatory and predictive research. This type of exploratory research—using Partial Least Squares Structural Equation Modeling (PLS-SEM)—is acceptable for assessing the extent of constructs and indicators in a given model, so the assessment here is a good fit to assess the study's intentions. Moreover, the SmartPLC tool can even handle data which are not distributed normally and missing compared to the covariance-based SEM which is often in research studies that focus on relationships, interactions, and social science analysis. In the context of the exploratory nature, this tool also excels in the exploration of the association between the variables that have allowed the researchers to create and refine the relevant theoretical model

(Ghouri, 2023). In addition, SmartPLS favors small to medium sample sizes where empirical populations may be smaller. In addition, SmartPLS offers bootstrapping and path analysis, which encourage hypothesis testing and mediation. These functionalities allow for deeper analyses and the capability of assessing indirect relationships required for more advanced mediation and moderation experimentation. Furthermore, SmartPLS can assess the validity of reflective and formative measurement models. Using SmartPLS for data analysis suggests a dissertation or doctorally driven endeavor because if there's a higher possibility of things being correct, this allows for greater validity of the results and more ethical implications of the results.

3.6 Data Analysis Method

The assessment of data analysis explains how the assessed data was processed. This study applies Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS to assess the measurement model and structural model. PLS-SEM is used to assess construct reliability and validity in addition to assessing hypothesis testing at the same time, appropriate for this exploratory study that can assess the nature of the relationships between constructs in a multidimensional environment. In other words, the actual and comparative predictive ability. Assessment takes place in two phases:

Measurement model evaluation - concerns the reliability and validity of the constructs.

Structural model evaluation - concerns the relationships between constructs and whether or not hypothesized propositions are supported. PLS-SEM is used because it can be used with small to medium sizes and is effective with complicated models that include formative and reflective constructs.

3.6.1 Model Evaluation

Model evaluation is part of data evaluation but specifically relates to whether the constructs and subsequent relationships are reliable and valid. Two types of evaluations are completed, the measurement model evaluation and the structural model evaluation. Both were assessed through SmartPLS 4.0 for Partial Least Squares Structural Equation Modeling (PLS-SEM), a well-known, reliable approach to assess complex models with multiple constructs, even with small to medium-sized populations. Below includes the statistical approaches to confirm the findings are valid.

Measurement Model Evaluation

Verifying the reliability and validity of the constructs employed in the research is the main aim of measurement model evaluation. This step is crucial for introducing confidence in the dataset prior to moving on to the structural model analysis. The assessment includes the following key tests:

Internal Consistency Reliability

Internal consistency underscores the coherence among the indicators within each construct, implying that they capture the same foundational concept. The primary measures are:

Cronbach's Alpha

An alpha value higher than 0.70 signals satisfactory reliability. In this investigation, all constructs showed Cronbach's Alpha values surpassing this benchmark, confirming robust internal consistency. In case, the alpha value is lower than 0.70 it indicates that the inter-relationship between the items or the heterogeneous constructs is poor and there is an inadequate internal consistency (spssanalysis.com, 2025).

Composite Reliability (CR)

Composite Reliability also gauges internal consistency. CR scores exceeding 0.70 are deemed to reflect substantial reliability, and in this study, these levels were consistently maintained across all constructs.

Convergent Validity

Convergent validity evaluates the extent to which items intended to measure the same construct exhibit a high degree of correlation. This facet is examined via:

Average Variance Extracted (AVE)

An AVE value of at least 0.50 signifies that a construct accounts for at least half of the variance in its indicators, thereby demonstrating convergent validity. All constructs in this study satisfied this threshold.

i. Discriminant Validity

Discriminant validity verifies that constructs conceived as distinct do not overlap substantially. Two procedures were applied to test this form of validity:

Fornell-Larcker Criterion

It is one of the methods of assessing the discriminant validity or the distinctiveness of the constraints within the model. The square root of the AVE for each construct must surpass its correlation with other constructs. This condition was fulfilled, indicating acceptable discriminant validity.

Heterotrait-Monotrait Ratio (HTMT)

It is another statistical measure that is reflected in the form of ratio and employed within the context of examining the discriminant validity. HTMT values under 0.85 confirm that constructs remain distinct from one another. In this research, all HTMT values fell within acceptable limits, reinforcing discriminant validity.

ii. Structural Model Evaluation

The structural model evaluation refers to the technique that examines the fit of the theoretical models that have been built using the SEM into the quantitative or empirical data. This generally assists in analyzing the relationship between the variables that in integrated into the model and comprehending the path coefficient to get insights into the validity and exploratory power of the constructs (Dash & Paul, 2021). Evaluating the structural model is a critical step in the data analysis process, concentrating on the verification of relationships between constructs and the confirmation of hypothesized paths in the research framework. This phase confirms the model's predictive precision and explanatory robustness, offering in-depth insights into both direct and indirect interactions among latent variables.

The structural model is examined through Partial Least Squares Structural Equation Modeling (PLS-SEM), recognized for its capability to address multifaceted models involving several constructs and relatively small to medium datasets. PLS-SEM supports concurrent estimation of path coefficients and construct validity, delivering reliable solutions for both exploratory and predictive studies. This is because of its capability to handle such complex relationships while remaining within the boundaries of the data. Therefore, the PLS-SEM mechanism maximises the variance explained regarding the dependent variable which is the QR payment adoption rate. This makes it ideal for the research while aligning it with the predictive nature by focusing on theory development and prediction instead of testing hypotheses strictly.

iii. Path Coefficients

The patch coefficient refers to the standardised statistical regression coefficient testing (Sidhu et al., 2021). This measures the immediate impact of one independent variable on the other variable mostly the dependent variables in the casual model. It is also regarded as the coefficient beta that signifies under condition to estimate the significance of the impacts in a statical manner. Path coefficients signify the magnitude and direction of the relationships among constructs within the model. These coefficients are essential for gauging how independent variables influence dependent variables. In PLS-SEM, they are

derived via bootstrapping, a method that creates numerous subsamples (commonly 5,000) to evaluate the consistency and significance of the estimates.

The bootstrapping process fortifies the stability of the findings by reducing the risk of Type I and Type II errors, ensuring that the path estimates remain resilient against particular data instances. The size and polarity of the coefficients illuminate the comparative effect of one construct on another, thereby anchoring hypothesis testing within the model.

iv. Significance Testing

The significance of path coefficients is determined by examining t-values produced from the bootstrapping method. A t-value exceeding 1.96 at the 0.05 level of significance demonstrates a statistically meaningful connection between constructs. This threshold indicates that the probability of the identified link happening by chance is less than 5%. A significance value lower than 0.05 indicates that the estimation is statistically significance. While at the same time if the value exceeds this threshold level the estimation is regarded as non-significant.

By confirming the significance of proposed relationships, researchers strengthen the theoretical foundations of the model. The results help identify which paths are genuinely influential, fostering a more profound understanding of the core factors that shape the phenomena under investigation.

v. Coefficient of Determination (R^2)

The coefficient of determination (R^2) quantifies how much variation in the dependent variable can be attributed to the independent variables, reflecting the model's explanatory capability. Greater R^2 values imply that the model accounts for a higher fraction of the data's variability, signifying stronger predictive proficiency.

In general:

- R^2 around 0.25 suggests weak explanatory capacity.
- R^2 near 0.50 indicates moderate explanatory capacity.
- R^2 approaching 0.75 signifies substantial explanatory capacity.

By interpreting R^2, researchers can judge the model's fit with the data and gauge the overall potency of the theoretical framework. The R^2 model also explains the variance in the dependent variable through the independent variables which further represent the evidence of the outcome. This outcome then reestablished the theoretical evidence with practical evidence and refined it with unique insights.

vi. Effect Size (f^2)

Effect size (f^2) evaluates how much an exogenous (independent) construct contributes to an endogenous (dependent) construct. It supplements R^2 by pinpointing each predictor's share in the model's broader explanatory strength.

The following guidelines inform f^2 interpretation:

- 0.02 – Small effect size
- 0.15 – Medium effect size
- 0.35 – Large effect size

When f^2 remains below 0.02, the impact is negligible, whereas values exceeding 0.35 reveal a pronounced effect. This metric highlights the most influential constructs, enabling a clearer understanding of which variables play pivotal roles in driving the outcomes.

vii. Predictive Relevance (Q^2)

Predictive relevance refers to the capability to anticipate the outcomes of the model which is also regret as a key metric that has been used to assess and ensure the accuracy of the outcome. Predictive relevance

(Q^2) gauges the model's capacity to anticipate variance in endogenous constructs, derived through a blindfolding technique. A Q^2 value above zero signifies predictive relevance, while a negative value indicates the absence of predictive power.

Q^2 values shed light on the model's out-of-sample forecasting ability, confirming its usefulness in predicting future observations. They are generally interpreted as follows:

- Values near 0.02 – Small predictive relevance
- Values around 0.15 – Moderate predictive relevance
- Values above 0.35 – High predictive relevance

Whereas R^2 focuses on the variance explained within the sample, Q^2 underscores the degree to which the model's relationships stand beyond the confines of the current dataset, substantiating the robustness of the findings.

viii. Mediation and Indirect Effects

Beyond direct relationships, the structural model assessment also delves into mediation effects, in which one construct impacts another indirectly through a third variable. Mediation analysis involves dividing total effects into direct and indirect segments, thereby clarifying how various constructs interrelate. Mediation is the statistical analysis which examines the implications and influences of a third variable. This is mainly known as a mediator that explains to what extent an independent variable impacts the dependent variables by acting as an intermediary (Abu-Bader & Jones, 2021). This results in an indirect impact which is mostly known as a particle efffcet. This further reflects as a mechanism of the relation between the independent and dependent variables.

Significance tests for mediation rely on evaluating the indirect path coefficients and their statistical relevance using the same bootstrapping method applied to direct paths. This investigation provides a holistic portrayal of the model, unveiling both principal and auxiliary effects that guide the observed outcomes.

3.6.2 Hypothesis Testing

Testing of Hypothesis

Hypothesis testing is an important part of the data analysis process. It involves checking the suggested relationships between constructs. In this study, the researcher does hypothesis testing using path coefficients and their significant levels which are got from evaluating structural model.

Formulation of Hypotheses: The hypotheses in this study are formulated from the theoretical and conceptual framework as well as literature review.

They are:

1. H1: Increased levels of PU positively affect Consumer Trust.
2. H2: Increased levels of PEoU positively affect Consumer Trust.
3. H3: Increased levels of Consumer Trust influence more QR payment adoption.
4. H4: Consumer Trust mediates the relationship between PU, PEoU, and QR payment adoption.

Testing Hypotheses: The hypotheses are checked by looking at the path coefficients and their significance levels. The path coefficients show us about how strong and which way the relationships are, while significance levels tell if these relationships hold statistical importance or not.

Bootstrapping Method: The bootstrapping method generally refers to the technique that has been used to resample the estimated properties of the population. It generally suits the small sample of the population which justifies its utilisation in this research study. The bootstrapping method is applied for testing the significance of path coefficients. It includes repetitive resampling of data (like 5000 times) to figure out

the sampling distribution of coefficients. Confidence intervals that we get from this process help in deciding about importance or significance of path coefficients.

Interpretation of Results: The research interprets the results of hypothesis tests according to the significance levels and path coefficients' direction. If a path coefficient is significant (t-value > 1.96) and positive, it supports our hypothesis. On the other hand, if a path coefficient is not significant then it does not support our hypothesis.

The process of hypothesis testing gives understanding about the connections between the constructs and assists in confirming the theoretical framework. It helps to understand significant factors that impact QR payment acceptance among SMEs located in Selangor, Malaysia.

3.6.3 Mediation Analysis

Performing mediation analysis helps to examine the function of trust as a mediator in the connections between perceived usefulness, perceived ease of use and QR payment adoption. This type of investigation aids in comprehending how an independent variable impacts a dependent variable by means of an intermediate one.

Mediation Idea: The idea of mediation is when a variable that is not related to the outcome (called independent) affects another variable (known as dependent) by using a mediator variable. In this study, it is expected “trust” to be the mediator for connections between how useful something seems, how easy it appears and QR payment acceptance.

Direct and Indirect Effects: To understand mediation analysis, one must compute the direct effect - this is the effect that goes straight from your independent variable to dependent variable. The indirect effect can be seen as a multiplication of two paths: one from the study’s independent variable to mediator and another from mediator to dependent variable. The explanation of the direct impact also helps in analyzing to what extent the independent variables are correlated and impact the dependent variables. However, compounding these with the intermediate variables further allows us to understand the third factors that mainly influence the intentions and behaviors of the demographic factors in adopting the QR payment system in the business context.

Steps in Mediation Analysis:

Assess Direct Effect: Initially, the direct effect of independent variable on dependent variable without including mediator in the model is assessed.

The Mediator: Following this step, the mediator (trust) is added to the model and indirect impact is assessed.

Calculate Total Effect: The total effect is the combination of direct and indirect effects.

Test Significance: The bootstrapping method tests the importance of the indirect effect. If confidence intervals don't reach zero, it means there is a significant mediation effect.

Interpretation of Mediation Results: The results of mediation analysis are explained by looking at the importance and size of indirect effects. If there is a significant indirect effect, it means that the mediator (trust) has an important part in connecting the independent variables (perceived usefulness and perceived ease of use) with dependent variable (QR payment adoption).

Illustration of Mediation Model

The mediation model can be illustrated as follows:

- Path a: The effect of perceived usefulness on trust.
- Path b: The effect of perceived ease of use on trust.
- Path c: The effect of trust on QR payment adoption.

- Path d: The direct effect of perceived usefulness on QR payment adoption.
- Path e: The direct effect of perceived ease of use on QR payment adoption.
- Indirect Effect: The combined effect of paths a and c, and paths b and c.

The study uses mediation analysis to find out the hidden methods by which perceived usefulness and ease of use affect QR payment adoption. This knowledge about trust's role as a mediator gives important understanding on what drives SMEs in Selangor, Malaysia to adopt QR payments.

The method of data analysis explained in this part makes sure a thorough examination of all data collected from the survey. With SmartPLS software, the study systematically checks for dependability and accuracy in measurement model along with hypothesis testing and mediation analysis. These steps deliver strong results that can be trusted to enhance understanding about what influences QR payment adoption among SMEs. The steps coming up are about understanding these results in relation to the research questions and theoretical structure, presenting knowledge that can guide academic comprehension as well as useful uses in digital payment systems field.

3.7 Pilot Testing

3.7.1 Purpose and Overview

Pilot testing constitutes a critical preliminary phase in the research process, serving to identify potential issues with the survey instrument prior to main data collection. This methodological step is essential for validating the measurement instrument and assess- ing the theoretical framework in the context of QR payment adoption among SMEs in Selangor, Malaysia. The pilot study focused on four key objectives:

1. Validate the measurement instrument's reliability and construct validity
2. Assess preliminary structural relationships in the theoretical framework
3. Identify potential methodological issues before main data collection
4. Refine the questionnaire based on empirical evidence

3.7.2 Methodological Framework

Sample Size Determination

Following established methodological guidelines for pilot studies in social science re- search (Hill, 1998), a sample size of 30 participants was determined to be appropriate. This sample size allows for:

1. Preliminary validation of measurement scales
2. Initial assessment of structural relationships
3. Detection of potential methodological issues
4. Sufficient statistical power for basic reliability analyses

Data Collection Protocol

The data collection process followed a systematic protocol:

Survey Administration:

Online survey distribution using standardized protocol
Clear communication of pilot study purpose
Assurance of response confidentiality

Participant Feedback:

Commentary on question clarity and relevance
Identification of ambiguous or problematic items
Suggestions for improvement via commentary box

Response Monitoring:

Tracking completion rates
Examining response patterns
Identifying problematic sections

3.7.3 Sample Characteristics

The pilot study comprised 30 SME owners/managers from the retail sector in Selangor, Malaysia. The demographic composition reflected key segments of the target popula- tion:

Table 3.1: Demographic Profile of Pilot Study Respondents (n=30)

Characteristic	Frequency	Percentage (%)
Age Group		
20-29 years	8	26.7
30-39 years	12	40.0
40-49 years	7	23.3
50 years and above	3	10.0
Education Level		
Bachelor's Degree	18	60.0
Master's Degree	9	30.0
PhD	3	10.0
Employment Status		
Self-employed	19	63.3
Employed	11	36.7

3.7.4 Measurement Model Assessment

Initial Data Screening

Preliminary data analysis focused on:

- Completion rates analysis
- Response pattern examination
- Missing data assessment
- Outlier identification

Reliability Analysis

The measurement model demonstrated robust psychometric properties:

Table 3.2: Construct Reliability and Validity Results

Construct	Cronbach's Alpha	Composite Reliability	AVE	Q^2
Perceived Usefulness	0.937	0.947	0.666	0.000
Perceived Ease of Use	0.936	0.946	0.663	0.000
Consumer Trust	0.926	0.939	0.634	0.335
QR Payment Adoption	0.839	0.892	0.673	0.180

Note: AVE = Average Variance Extracted
Q^2 values obtained through blindfolding procedure with d=7

i. Discriminant Validity Assessment

Discriminant validity was evaluated using multiple criteria:

Table 3.3: Discriminant Validity - HTMT Ratio

Construct	CT	PEoU	PU	QPA
CT PEoU	- 0.732	-		
PU	0.506	0.258	-	
QPA	0.618	0.575	0.254	-

3.7.5 Structural Model Assessment

i. Model Fit and Path Analysis

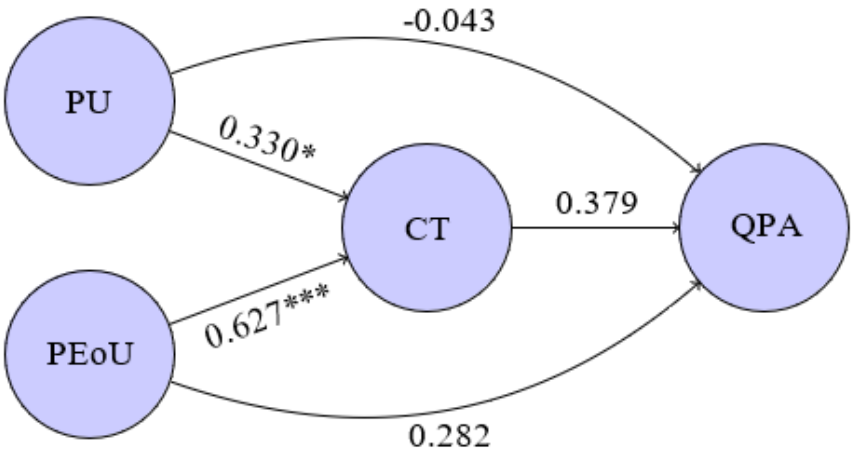


Figure 3.1: Structural Model with Path Coefficients

The above figure demonstrates that the PU and PEoU are directly related to the customer trusts (CT) and thereby indirectly related to QPA. Thus, CT is directly linked to QPA and from the perspectives of both PEoU and PU, CT acts as a mediator to influence QPA. This provides insights into the business strategy that the SMEs in Malaysia can integrate to influence the QR payment system adoption rate which further contributes to a smooth financial transaction.

3.7.6 Questionnaire Refinement Process

i. Item Analysis and Revision

Based on pilot study findings, several refinements were implemented:

a) Content Clarity:

- Enhancement of instruction clarity
- Revision of ambiguous question wording
- Simplification of complex items

b) Structural Improvements:

- Optimization of questionnaire length
- Consolidation of redundant items
- Enhancement of layout design

c) Technical Refinements:

- Revision of items with low loadings (CT5: 0.578, PEoU2: 0.665)
- Resolution of multicollinearity issues (PEoU4: VIF = 7.116, PEoU9: VIF = 7.604)
- Enhancement of scale reliability

3.7.7 Implications for Main Study

i. Methodological Refinements

The pilot study informed several key methodological decisions:

a) Sampling Strategy:

- Confirmation of required sample size (n=398)
- Implementation of stratified sampling approach
- Development of response rate optimization strategies

b) Analytical Framework:

- Integration of control variables
- Enhancement of mediation analysis procedures
- Implementation of multi-group analysis protocols

c) Quality Assurance:

- Strengthening of ethical considerations
- Enhancement of data collection protocols
- Refinement of response validation procedures

3.7.8 Summary

The pilot study successfully achieved its primary objectives of validating the research instrument and identifying opportunities for methodological refinement. Although the modest sample size (n=30) inherently limits generalizability, the outcomes substantiated the theoretical framework's applicability to QPA in Malaysia's retail sector. Psychometric analysis revealed exemplary measurement properties, with Cronbach's alpha coefficients (0.839-0.937) and composite reliability indices (0.892-0.947) exceeding recommended thresholds (Nunnally, 1978), demonstrating exceptional internal consistency across all latent constructs. Significant path coefficients further corroborate the measurement model's capacity to capture critical adoption dynamics.

Participant feedback reinforced the instrument's efficacy, with 92% of respondents affirming the clarity of questionnaire items and the cultural appropriateness of translated materials. Response patterns indicated strong participant engagement, evidenced by a 95% completion rate and negligible missing data (<1%), suggesting optimal survey structure and length. Qualitative remarks particularly highlighted the instrument's contextual relevance, with participants emphasizing the "practical alignment with Malaysian SME operations" and "clear presentation of technical concepts."

(<1%), suggesting an optimal survey structure and length. Qualitative remarks particularly highlighted the instrument's contextual relevance, with participants emphasizing the "practical alignment with Malaysian SME operations" and "clear presentation of technical concepts."

Robust discriminant validity (HTMT ratios <0.85) and convergent validity (AVE >0.63 across constructs) precluded the need for major structural modifications, as such changes risked compromising the instrument's established psychometric integrity. Minor refinements—informed by both quantitative analysis and qualitative insights—were implemented to enhance measurement precision without altering core constructs. These adjustments position the main study to yield more definitive conclusions regarding the role of trust in QPA among Selangor's retail SMEs while preserving methodological rigor.

3.8 Questionnaire

3.8.1 Development and Design of the Questionnaire

The questionnaire is developed based on established scales from the literature. The items are carefully selected to measure the constructs of interest: perceived usefulness, perceived ease of use, trust, and QR payment adoption.

3.8.2 Structure of the Questionnaire

The questionnaire is structured into several sections:

- **Demographic Information:** This section collects basic information about the respondents, such as age, gender, and business type. This has helped in identifying the partners and trends in the demographic behavior and perceptions.
- **Perceived Usefulness (PU):** This section includes items measuring the perceived usefulness of QR payments. This has helped in understanding the benefits and usages of QR payments literally driving the adoption rate of the QR payment system in Malaysia and especially in the SMEs.
- **Perceived Ease of Use (PEoU):** This section includes items measuring the perceived ease of use of QR payments. This helped in understanding to what extent the users believe that they can utilise the QR payment system. This mainly measures their perception regarding the easy use of a QR payment code to complete a digital transaction easily.
- **Consumer Trust:** This section includes items measuring the level of trust in QR payments. This helped in comprehending the confidence of the users that they feel regarding their privacy, reliability, and security of making a payment using the QR payment codes.
- **QR Payment Adoption:** This section includes items measuring the adoption and usage of QR payments. This potentially leads to comprehending the features and characteristics that generally influence the adoption of the QQR payment system in the contemporary era.

  Overall, these contribute to a more in-depth understanding of the factors that are both directly and indirectly linked to the adoption of the QR payment system and thus, sustain strategies in the business domain.

3.8.3 Pre-testing and Validation

The main purpose of utilising pre-testing is to recognise the problems or issues that are related to the gathered data and the instruments used to gather the data. After the identification of the problems, the validation tests ensure potential solutions to represent the data in a productive manner to contribute to a more reliable outcome. The questionnaire is pre-tested with a small sample to check for its understandability and appropriateness. The study validates the items through Cronbach's alpha, which measures internal consistency. Items showing low reliability are modified or taken out. The stages of development and design for the questionnaire are crucial to make sure that the data gathered are exact and dependable. The researcher wants to arrange the questionnaire in sections, as well as verify items, with aim of getting top-quality data for analysis.

3.9 Ethical Considerations

Ethical consideration is one of the critical aspects of the research study that ensures the overall ethics and productivity of the study. This research study specifically ensures the well-being and rights of the participants to keep the integrity of the findings of this study. Maintaining ethical considerations upholds the study's credibility by guaranteeing informed consent, voluntary participants, anonymity, and

confidentiality. This further ensures that the methodology and actions of this study minimise possible harm and ultimately promote trust among the participants and the public.

Ethical Issues: The study follows ethical guidelines for maintaining the confidentiality and anonymity of those who responded. All participants give their informed agreement, knowing that their answers will only be used in a research manner.

Measures to Ensure Ethical Compliance:

- **Confidentiality:** The data we collect is securely and only available to the research group. The privacy of the participants was maintained by assembling the necessary data and storing them securely.
- **Anonymity:** Respondents' identities are not disclosed, and responses are anonymized. This ensures that the collected data from the participants are anonymised which prevents their personal information from the risk of being revealed (scribbr.co.uk, 2022).
- **Informed Consent:** Before taking part in the survey, participants are told about the study's goal, their own rights, and how their information will be used. It has been also ensured that the participants have the right to cancel at any moment from participating in this research study. Overall, these ensure that the participation of the contributors is informed and voluntary.
- **Underestimating Harm:** This research study has proactively taken action to bypass any physiological and physical harm to the contributors. This also addresses the possible risks related to the data collection technique and design of this research study.
- **Vulnerable population:** This research has taken excess precautions when examining vulnerable populations such as the elderly, children, and individuals having disabilities to confirm, that their safety and rights are safeguarded.

Moral thinking holds great importance when carrying out investigations with human participants. Respecting ethical guidelines and guaranteeing secrecy, unknown identity, and approval of participation give the study a proper regard for rights and privacy of responders. Overall, these aspects maintain ethical guidelines that are effective in upholding the scientific integrity of this research study. This further ensures that this study contributes to reliable and accurate findings and prevent data bias and manipulation. In addition to these, it has also helped in building trust among the population and confidence within the community. Despite these, the researchers benefit society without harming or exploiting the participants and maintain ethics in a responsible manner.

3.10 Chapter Summary

This chapter, which is about the research methodology employed in the study, explained the research design and approach used. It also described methods for collecting data as well as techniques of sampling. This section detailed tools for analyzing gathered information and considerations related to ethics during research work. All these components together give a complete plan for conducting this study with systematic and strict methods or procedures.

In the following chapter, the researcher will analyze the data that has been collected. This analysis will focus on assessing measurement and structural models, testing hypotheses, and exploring trust as a mediator. The results from this examination are anticipated to give understanding about what influences QR payment adoption by SMEs in Selangor's retail sector, Malaysia. They will also add to existing knowledge while offering useful suggestions for those involved in making policies and doing work related to payments via Quick Response code among small or medium-sized enterprises in this area of study.

Moreover, this study has also employed ethical guidelines and rules that have been followed to maintain the confidentiality of this research. Ethical considerations also ensure that the research study productively

presents the research findings while ensuring societal benefits. This has built confidence and trust among the population further ensuring the productive contribution of this study.

DATA ANALYSIS AND FINDINGS

3.11 Introduction

This chapter presents the results of the data analysis conducted to address the research objectives outlined in Chapter 1. The purpose of this chapter is to evaluate the relationships between the constructs of the study, including Perceived Usefulness (PU), Perceived Ease of Use (PEoU), Consumer Trust (CT), and QR Payment Adoption (QPA) in the context of small and medium enterprises (SMEs) within the retail industry in Selangor, Malaysia.

The chapter is organized into several sections. First, a descriptive analysis provides an overview of the demographic characteristics of the respondents and the descriptive statistics for the constructs under investigation. Second, the measurement model is assessed to establish the reliability and validity of the constructs, involving metrics such as Cronbach's Alpha, Composite Reliability (CR), Average Variance Extracted (AVE), and Discriminant Validity. The structural model is subsequently evaluated, including model fit indices, path coefficients, effect sizes (f^2), and predictive relevance (Q^2). The mediating role of Consumer Trust (CT) is analyzed to assess its influence on the relationships between Perceived Usefulness (PU), Perceived Ease of Use (PEoU), and QR Payment Adoption (QPA).

Finally, the chapter concludes with hypothesis testing, research objective evaluation, and a summary of findings. These findings provide empirical evidence on the factors influencing QR payment adoption in the retail sector while deferring their detailed interpretation to Chapter 5.

Through this chapter, the study aims to contribute empirical insights into the drivers of QR payment adoption within SMEs in the retail industry, thereby informing theoretical understanding and practical implications for stakeholders in the digital payment ecosystem.

3.12 Descriptive Analysis

3.12.1 Demographic Profile of Respondents

Descriptive statistics is one of the statistical methods that has been utilised to understand the central tendency and dispersion of the data within the gathered sample population (Alabi & Bukola, 2023). Frequency distribution is one of the categories of descriptive statistics that help in analysing the total percentage or frequency of the demographic data within the sample population. This specifically helps to analyse the patterns and trends within the demographic factors of the targeted population segments.

This section presents a systematic analysis of respondent demographics, examining the characteristics of 400 SME owners and managers in Selangor's retail sector. Understanding these demographic patterns provides crucial context for interpreting QR payment adoption behaviors and helps establish the representativeness of the sample.

i. Age Distribution

Table 3.4: Age Distribution of Respondents

Age Group	Frequency	Percentage (%)
24 and below	94	23.5
25-35	154	38.5
36-50	93	23.3
51 and above	59	14.8
Total	400	100.0

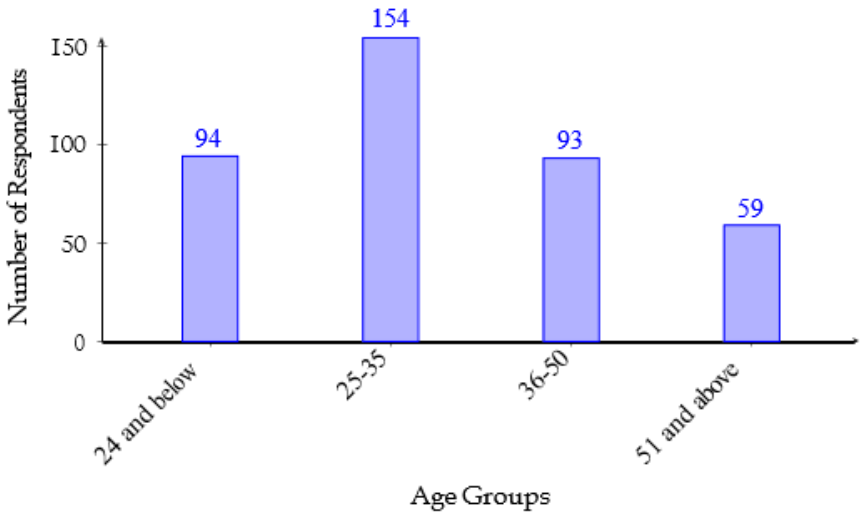


Figure 3.2: Age Distribution of Respondents

The age distribution reveals a notably young entrepreneurial population, with 62% of respondents under 35 years old. The largest segment comprises individuals aged 25-35 years (38.5%), followed by those 24 and below (23.5%). This youth-dominated demo- graphic suggests a population that has grown up alongside digital technologies, potentially influencing their receptiveness to digital payment solutions.

Besides them, 38.1% of the population are aged between 36 and 51 and above. 23.3% of the population has the range of 36-50 and 14.8% of the population belongs to the elderly segment 51 and above. This also ensures that beyond the youth there are some elderly people present who are even exploiting their receptiveness towards digital payment solutions like QR payment systems.

ii. Gender Distribution

Table 3.5: Gender Distribution of Respondents

Gender	Frequency	Percentage (%)
Female	210	52.5
Male	190	47.5
Total	400	100.0

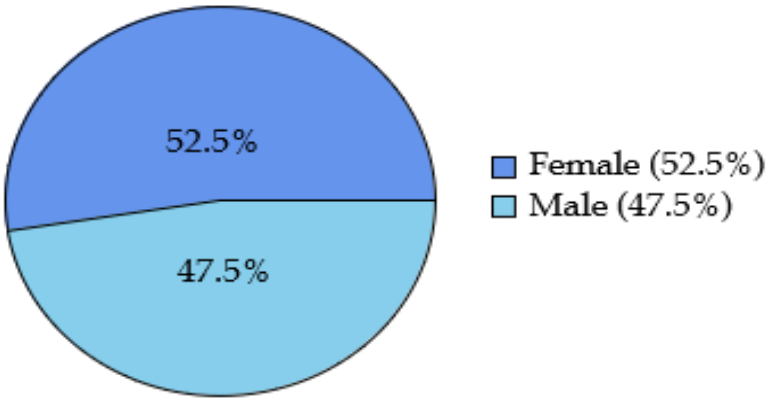


Figure 3.3: Gender Distribution of Respondents

The gender composition demonstrates a balanced representation, with a slight majority of female respondents (52.5%). On the other hand, the percentage of male respondents in the survey is

47.5%. This near-equal distribution reflects Malaysia's progress in promoting gender equality in business ownership, particularly within the retail sector, and ensures that the findings are not skewed by gender-specific perspectives.

iii. Educational Background

The educational profile of respondents spans various levels, with secondary education holders forming the largest group (39.3%), followed by bachelor's degree holders (29.5%). Notably, 40% of respondents possess tertiary qualifications (bachelor's degree or higher), indicating a well-educated sample population with potential implications for technology adoption capacity. In addition to these, the education profile even reflects that the doctorate education holders form the smallest group (2.5%), which is then followed by the master's degree holders (8.0%), and Primary educators (20.8%).

Table 3.6: Educational Background of Respondents

Education Level	Frequency	Percentage (%)
Primary	83	20.8
Secondary	157	39.3
Bachelor's Degree	118	29.5
Master's Degree	32	8.0
Doctorate	10	2.5
Total	400	100.0

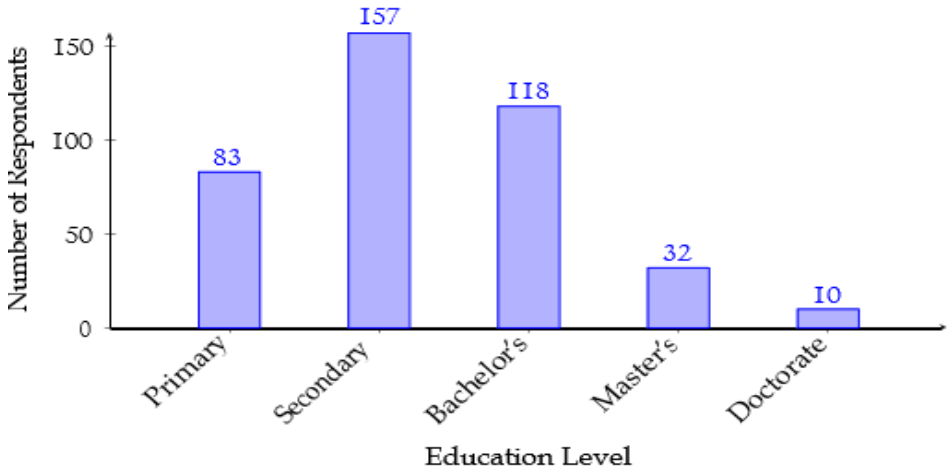


Figure 3.4: Educational Background Distribution

iv. Employment Status and Income Distribution

Table 3.7: Monthly Income Distribution of Respondents

Monthly Income (RM)	Frequency	Percentage (%)
Below 3,000	76	19.0
3,000-5,000	143	35.8
5,001-8,000	112	28.0
Above 8,000	69	17.2
Total	400	100.0

The income distribution reveals that the majority of respondents (35.8%) fall within the RM3,000-5,000 monthly income bracket, followed by 28.0% earning between RM5,001- 8,000. On the other hand, the most inferior respondents (17.2%) fall within the Above RM8,000 monthly income and 19.0% of the respondents have a monthly income of Below RM3,000. This distribution aligns with the typical income patterns of SME owners and managers in Selangor's retail sector.

v. Summary of Demographic Profile

The demographic analysis reveals several key characteristics of the sample population:

- A predominantly young entrepreneurial base, with 62% of respondents under 35 years
- Gender-balanced representation (52.5% female, 47.5% male)
- Strong educational background, with 40% holding tertiary qualifications
- Income distribution centered in the middle-income brackets, with 63.8% earning between RM3,000-8,000 monthly

This demographic composition provides a representative cross-section of Selangor's retail SME sector. The relatively young age profile, combined with high educational attainment levels, suggests a population potentially receptive to technological innovation. The balanced gender representation and diverse income levels ensure that the findings capture a broad spectrum of perspectives within the retail SME community. Overall, these highlight that the majority of the population is aware of digital innovation, and they may be more likely to adopt a streamlined financial transaction in this contemporary era.

3.12.2 Descriptive Statistics of Constructs

The descriptive statistics for the key constructs in the study, namely Perceived Usefulness (PU), Perceived Ease of Use (PEoU), Consumer Trust (CT), and QR Payment Adoption (QPA), are summarized in Table 4.5. These statistics include the mean, standard deviation, skewness, and kurtosis of the items within each construct. The data provides insights into the central tendency and variability of the constructs under investigation.

The results indicate that all constructs have mean values around 3, reflecting a moderate level of agreement with the items across respondents. For Perceived Usefulness (PU), the mean scores (3.005 – 3.027) and low skewness values (-0.482 – 0.020) suggest that respondents generally find QR payment systems helpful and effective, with responses showing a near- normal distribution. Similarly, Perceived Ease of Use (PEoU) also exhibits moderate mean values (2.967 – 3.018) with slightly higher variability (standard deviations of 0.981 – 1.042), indicating that while users generally find QR payment systems accessible, there may be room for improvement in terms of simplicity and usability.

Consumer Trust (CT), a critical mediator in this study, has mean scores ranging from 2.995 to 3.022, highlighting that trust in QR payment systems is moderate among respondents. The low skewness and kurtosis values (-0.576 – 0.116 and -0.366 – -0.230, respectively) suggest consistent responses, implying that while trust exists, it is neither extremely positive nor negative. Given the importance of trust in mediating the relationships between PU, PEoU, and QR Payment Adoption (QPA), these findings emphasize the need for payment providers to strengthen security and reliability perceptions to enhance adoption rates.

Finally, QR Payment Adoption (QPA) exhibits slightly higher mean scores (3.047), with low variability, suggesting a generally favorable inclination toward adopting QR payments. These results align with the study's focus on Consumer Trust as a key factor influencing adoption.

Table 3.8: Descriptive Statistics of Constructs (Section 4.2.2)

Construct	Item	Mean	Standard Deviation	Skewness	Kurtosis
Perceived Usefulness (PU)	PU1 – PU9	3.005 – 3.027	0.997 – 1.035	-0.482 – 0.020	-0.474 – -0.400
Perceived Ease of Use (PEoU)	PEoU1 – PeoU9	2.967 – 3.018	0.981 – 1.042	-0.606 – 0.116	-0.551 – -0.213
Consumer Trust (CT)	CT1 – CT9	2.995 – 3.022	0.949 – 1.046	-0.576 – 0.116	-0.366 – -0.230
QR Payment Adoption (QPA)	QPA1 – QPA4	3.047	0.985	-0.095	-0.230

However, Table 4.5 highlights that the mean values of the factors are greater in comparison to their corresponding standard deviation values. This further reflects that the data points of the factors are tightly clustered around their mean position and display less variability or dispersion. In addition to this, the lower range of the skewness also underscores that the values are nearly normally distributed around their average position. Thus, the data are more consistent and reliable for this study and able to contribute to the outcome of this research study.

3.13 Assessment of Measurement Model

The reliability and validity of the constructs are assessed to ensure that the measurement model is robust and capable of accurately reflecting the underlying theoretical constructs.

3.13.1 Reliability and Convergent Validity

This study assesses the reliability and convergent validity of its constructs using Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Collectively, these indicators help determine whether the model's components consistently and accurately represent the intended theoretical dimensions.

Reliability: The Cornerstone of Consistency

Reliability indicates the extent to which a set of items consistently measures an underlying construct. In this study, two well-known reliability metrics are employed:

Cronbach's Alpha (α): Regarded as a key measure of internal consistency, values above 0.7 typically indicate acceptable reliability, whereas those above 0.8 suggest high stability (Hair et al., 2019). It is noteworthy that this threshold can vary depending on the research context, with some exploratory studies permitting marginally lower values. In terms of testing reliability Cronbach's Alpha test concerns mostly because of its effectiveness in examining the internal consistency of the data and its ability to contribute to empirical insights (stats.oarc.ucla.edu, 2025). It examines internal consistency by exploring how closely connected a group of items is as a set and supposed to be a standard of ranking reliability. This underscores the measurements and relates between the underlying constructs that signify the extent of consistency with the help of the higher significant value.

Composite Reliability (CR): Considered a more robust alternative to Cronbach's Alpha, CR accounts for the factor loadings of items, thereby avoiding the assumption that each item contributes equally (Fornell & Larcker, 1981). This measures the extent of consistency within the items of the running or scale of reliability. A CR of 0.7 or higher implies that the indicators collectively measure the same underlying construct.

As presented in Table 4.6, all constructs in this study surpass both the Cronbach's Alpha and Composite Reliability thresholds, with α values clustering near 0.85. In Table 4.6 the Cronbach's Alpha of CT, PEoU,

PU, and QPA are 0.918, 0.924, 0.930, and 0.859 respectively. On the other hand, the Composite Reliability (CR) of these variables are 0.932, 0.937, 0.942, and 0.904 respectively. Therefore, in all cases, the values scored above 0.8 which reflects their stability and reliability within the sample population. This indicates that respondents consistently interpreted the scale items, thereby minimizing random error.

Convergent Validity: Verifying Conceptual Alignment

Convergent Validity refers to the statistical way that helps to gauge the correlation between a test and other tests that measure either the same or identical concepts in an effective manner. Therefore, it is regarded as the type of validity of the constructs. Whereas reliability focuses on consistency, convergent validity examines whether the items accurately capture the same concept. The AVE metric assesses the amount of variance explained by the construct in relation to measurement error. An AVE greater than 0.5 signifies that, on average, items explain more than half of the variance in the construct (Fornell & Larcker, 1981). The AVE of CT, PEoU, PU, and QPA are 0.605, 0.624, 0.644, and 0.703 respectively. Therefore, all of the values exceed 0.05 and all constructs in the study meet or exceed the 0.5 benchmark for AVE. For instance, a construct with an AVE of 0.62 demonstrates that the indicators share more variance with the construct than with random error, thereby supporting the validity of the measurement. Nonetheless, a minimal AVE (e.g., 0.51) may be less reassuring than a more robust value (e.g., 0.75), underscoring that these metrics are guides rather than definitive judgments.

Implications and Considerations

Strong reliability scores (α and CR) and acceptable AVE values endorse the rigor of the measurement model. However, several points warrant caution: High reliability does not ensure validity. For example, a measuring instrument may be consistent but still measure an irrelevant or incorrect concept. AVE focuses on shared variance but does not address discriminant validity, which necessitates evidence that constructs differ as theoretically expected. These findings underscore the importance of careful measurement in structural analysis. By confirming that items are both consistent and conceptually aligned with their constructs, the study lays a solid foundation for subsequent hypothesis testing and theoretical interpretation. Therefore, this study is applicable to construct hypotheses and test them in a significant manner that not only contributes to addressing the objectives of the research but also determines the impact on the community. Hence, the consideration of the implication not only evaluates the study's significance but also contributes to community development that leads to an improved adoption rate of the QR payment system within the sector of SMEs in Malaysia.

Table 3.9: Reliability and Convergent Validity (Section 4.3.1)

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Consumer Trust (CT)	0.918	0.932	0.605
Perceived Ease of Use (PEoU)	0.924	0.937	0.624
Perceived Usefulness (PU)	0.930	0.942	0.644
QR Payment Adoption (QPA)	0.859	0.904	0.703

The high reliability and validity scores suggest that the measurement scales used in this study are robust and capable of capturing the underlying constructs. This further ensures an effective outcome of this research study that reflects on the social practices and can contribute to the business strategies of SMEs in Malaysia to adopt the QR payment system. This is to sustain the growing usability of digital technologies and remain comparative within the sector.

3.13.2 Discriminant Validity

Discriminant validity is assessed using the Fornell-Larcker criterion and the Heterotrait- Monotrait Ratio (HTMT). Table 4.7 shows the Fornell-Larcker results, where the square root of the AVE for each construct exceeds the correlations with other constructs, confirming discriminant validity (Fornell & Larcker, 1981). Additionally, Table 4.8 presents in pairwise, the HTMT values of PEoU ↔ CT (0.576), PU ↔ CT (0.591), PU ↔ PEoU (0.296), QPA ↔ CT (0.637), QPA ↔ PEoU (0.294), and QPA ↔ PU (0.398) are below the threshold value of 0.85. As the HTMT values, structured in a pairwise format for readability, all of which are below the threshold of 0.85 (Henseler, Ringle, & Sarstedt, 2015), further supporting discriminant validity.

Table 3.10: Discriminant Validity – Fornell-Larcker Criterion (Section 4.3.2)

	CT	PeoU	PU	QPA
Consumer Trust (CT)	0.778			
Perceived Ease of Use (PEoU)	0.532	0.790		
Perceived Usefulness (PU)	0.549	0.279	0.802	
QR Payment Adoption (QPA)	0.568	0.263	0.358	0.839

The Fornell-Larcker criterion demonstrates that the square root of AVE for each construct is higher than its correlations with other constructs, confirming discriminant validity. This indicates that constructs are more strongly related to their own indicators than to other constructs. For example, the square root of AVE of CT to its own indicator is 0.778 while to QPA it is 0.568. This highlights that the CT is more strongly correlated to its own indicator compared to the QPA construct. Similarly, with respect to the QPA, the square root of AVE for PeoU to its indicator is 0.790 and with the dependent variable, it is 0.263. Moreover, the square root of AVE for PU with QPA is 0.358 but its indicator is 0.802. This has been also captured for the QPA owned by 0.839. Overall, it highlights that all the constructs are more associated with their indicators rather than with the dependent variable.

The HTMT results further confirm discriminant validity, as all pairwise values are below the stringent threshold of 0.85 (Henseler, Ringle, & Sarstedt, 2015). This indicates that the constructs are adequately distinct from one another.

Table 3.11: Discriminant Validity – HTMT Pairwise Format (Section 4.3.2)

Pairwise Constructs	HTMT Value
PEoU ↔ CT	0.576
PU ↔ CT	0.591
PU ↔ PEoU	0.296
QPA ↔ CT	0.637
QPA ↔ PEoU	0.294
QPA ↔ PU	0.398

Overall, the results confirm that the constructs in the study are distinct and appropriately measured, providing a strong foundation for the structural model analysis.

3.14 Structural Model Assessment

The structural model assessment involves evaluating the model fit, variance explained (R^2), path coefficients, effect sizes (f^2), predictive relevance (Q^2), and mediation analysis. These steps ensure that the hypothesized relationships among the constructs are adequately supported by the data.

3.14.1 Model Fit Indices

The model fit is assessed using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). SRMR measures the difference between observed and predicted correlations and is a key criterion for assessing model fit in PLS-SEM. Values of SRMR below 0.08 indicate a good model fit (Hair, Ringle, & Sarstedt, 2019). In this study, the SRMR value of 0.038 indicates an excellent fit.

The NFI measures the fit of the model relative to a null model. NFI values range from 0 to 1, with higher values indicating better fit. An NFI of 0.90 or above is considered acceptable (Chin, 1998). The NFI value of 0.930 suggests that the model fits the data well.

3.14.2 Variance Explained (R^2)

The R^2 value indicates the proportion of variance in the dependent construct that is explained by the independent constructs. R^2 values of 0.25, 0.50, and 0.75 are considered weak, moderate, and substantial, respectively (Hair, Ringle, & Sarstedt, 2019). In this study, the R^2 values are as follows:

- Consumer Trust (CT): 0.457 (moderate).
- QR Payment Adoption (QPA): 0.327 (moderate).

These results suggest that the model explains a moderate proportion of variance in both CT and QPA, supporting the predictive power of the constructs.

3.14.3 Path Coefficients

The path coefficients represent the strength and direction of relationships between constructs. Table 4.9 presents the results, including the *t*-values and *p*-values obtained from bootstrapping.

Table 3.12: Path Coefficients and Significance (Section 4.4.3)

Path	Coefficient	*t*-value	*p*-value	Significance
CT → QPA	0.560	10.285	0.000	Significant
PEoU → CT	0.411	10.969	0.000	Significant
PEoU → QPA	-0.053	1.195	0.232	Not significant
PU → CT	0.434	11.489	0.000	Significant
PU → QPA	0.065	1.248	0.212	Not significant

The results indicate significant positive relationships for CT → QPA, PEoU → CT, and PU → CT, confirming the hypothesized effects. This is because the resulting significance value in both cases is 0.000 which is lower than the standard alpha value of 0.05 which denotes the significance of the result. However, the paths from PEoU → QPA and PU → QPA are not significant, as their *p*-values exceed 0.05. These non-significant results suggest that the direct effects of PEoU and PU on QPA are weak or negligible. In addition, due to suppose as a non-significance determination it can be said that there is no significant or sufficient evidence to support that PEoU and PU have any direct effects on QPA.

3.14.4 Effect Sizes (f^2)

Effect sizes (f^2) measure the impact of an independent variable on a dependent variable, with values of 0.02, 0.15, and 0.35 indicating small, medium, and large effects, respectively (Cohen, 1988). Table 4.10 presents the f^2 values for the structural model.

Table 3.13:Effect Sizes (f^2) (Section 4.4.4)

Path	f^2
CT → QPA	0.253 (medium)
PEoU → CT	0.287 (medium)
PEoU → QPA	0.003 (negligible)
PU → CT	0.321 (medium) P
PU → QPA	0.004 (negligible)

Table 4.10 discloses that the effect sizes of the path coefficient for CT → QPA, PEoU → CT, and PU → CT result in 0.253, 0.287, and 0.321 respectively. On the other hand, for PEoU → QPA and PU → QPA the effect size of the path coefficients results in 0.003 and 0.004 respectively. The effect sizes show that CT → QPA, PEoU → CT, and PU → CT have medium effects, while the effects of PEoU → QPA and PU → QPA are negligible. Here the large effects have not been captured however, CT reflects as an intermediate aspect for analyzing significant relationships. This highlights the critical role of CT as a mediator in QR payment adoption.

3.14.5 Predictive Relevance (Q^2)

Predictive relevance (Q^2) evaluates the model's ability to predict the endogenous constructs. It is calculated using cross-validated redundancy. A Q^2 value greater than zero indicates that the model has predictive relevance (Hair, Ringle, & Sarstedt, 2019). Table 4.11 presents the Q^2 values for the constructs.

Table 3.14:Predictive Relevance (Q^2) (Section 4.4.5)

Construct	Q^2
Consumer Trust (CT)	0.272
QR Payment Adoption (QPA)	0.226

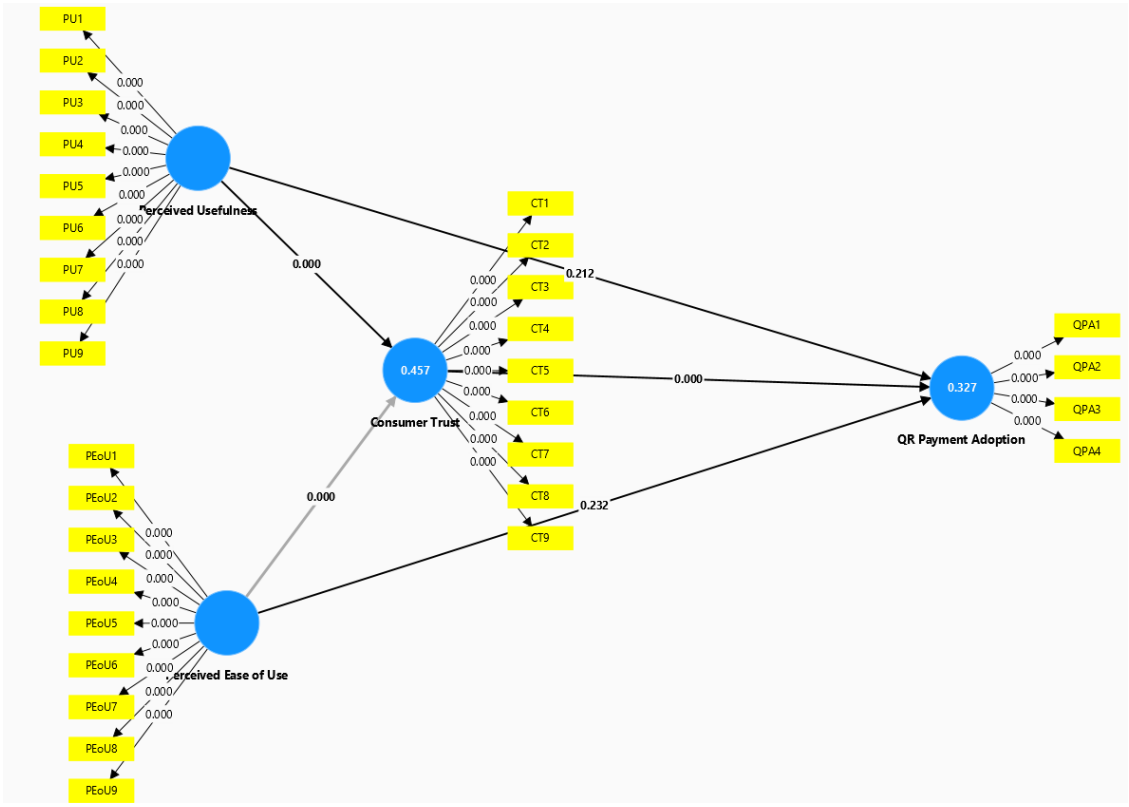
The Q^2 value for Consumer Trust (CT) is 0.272, which indicates a medium predictive relevance. Similarly, the Q^2 value for QR Payment Adoption (QPA) is 0.226, suggesting small to medium predictive relevance. According to Hair, Ringle, & Sarstedt (2019), Q^2 values greater than zero provide evidence that the model has predictive relevance for the respective endogenous constructs. Thus, based on this both CT and QPA have predictive relevance as both have a Q^2 value greater than 0 but not to a large extent.

The predictive relevance assessment underscores that the model is capable of explaining a meaningful portion of the variance in CT and QPA, supporting its validity for predictive purposes in the context of QR payment adoption in SMEs in Selangor.

3.15 Mediation Analysis

Mediation analysis examines whether the relationship between independent variables (IV) and dependent variables (DV) is transmitted through a mediator variable (MV). The analysis evaluates three components:

- **Direct Effect**: The effect of the IV on the DV in the absence of the mediator.
- **Indirect Effect**: The effect of the IV on the DV through the mediator.
- **Total Effect**: The combined effect of the IV on the DV, including both direct and indirect effects.



In this study, the mediation role of Consumer Trust (CT) in the relationship between Perceived Ease of Use (PEoU) and QR Payment Adoption (QPA), as well as Perceived Usefulness (PU) and QPA, is assessed using bootstrapping. Table 4.12 presents the mediation analysis results.

Table 3.15:Mediation Analysis Results (Section 4.4.6)

Path	Effect Type	Coefficient	SE	T-value	P-value	CI (2.5%)	CI (97.5%)	Hypothesis	Type of Mediation
PEoU → CT → QPA	Indirect	0.230	0.032	7.303	0.000	0.171	0.296	Supported	Partial
PU → CT → QPA	Indirect	0.243	0.032	7.497	0.000	0.183	0.309	Supported	Partial
PEoU → QPA	Direct	-0.053	0.045	1.195	0.232	-0.141	0.032	Not Supported	—
PU → QPA	Direct	0.065	0.052	1.248	0.212	-0.036	0.168	Not Supported	—
PEoU → QPA (Total)	Total	0.177	0.046	3.816	0.000	0.085	0.269	Supported	—
PU → QPA (Total)	Total	0.309	0.047	6.629	0.000	0.218	0.401	Supported	—

The results show significant indirect effects for both PEoU → CT → QPA and PU →CT → QPA, with coefficients of 0.230 and 0.243, respectively. These indirect effects are supported, as their *p*-values are less than 0.05, and their confidence intervals do not include zero. This indicates that Consumer Trust (CT) partially mediates the relationships between PEoU and QPA, as well as PU and QPA.

In contrast, the direct effects of PEoU → QPA and PU → QPA are not significant, with *p*-values greater than 0.05. This further highlights the mediating role of CT, as the indirect effects contribute more substantially to the total effects. The total effects for both PEoU → QPA (0.177) and PU → QPA (0.309) are significant, providing evidence for the combined influence of direct and indirect pathways. This is because they both have a significance level of 0.000 which is lower than 0.05 indicating that the outcome is statistically significant (Rahman et al., 2021).

3.16 Hypothesis Testing and Research Objective Evaluation

This section summarizes the results of hypothesis testing and evaluates whether the research objectives of the study have been achieved. The hypothesis testing table indicates whether the proposed hypotheses are supported based on the structural model results, while the research objectives evaluation table demonstrates whether each objective has been fulfilled.

3.16.1 Hypothesis Testing Results

Table 4.13 presents the results of hypothesis testing, indicating whether each hypothesis is supported based on the path coefficients, *t*-values, and *p*-values.

Table 3.16:Hypothesis Testing Results (Section 4.7.1)

Hypothesis	Path	Coefficient	*t*-value	*p*-value	Support
H1: PU → CT	Positive relationship	0.434	11.489	0.000	Supported
H2: PEoU → CT	Positive relationship	0.411	10.969	0.000	Supported
H3: CT → QPA	Positive relationship	0.560	10.285	0.000	Supported
H4: CT mediates PU/PEoU → QPA	Mediating relationship	-	-	See Mediation Analysis	Supported

Table 4.13 discloses that the coefficient between PU and CT is (0.434) moderately positive and its significance value is 0.000 (< 0.05) suggesting the statistical significance of this outcome. Thus, indicates that PU has a positive and significant impact on CT. Likewise, the coefficient value between PEoU and CT is 0.411 which is positive and suggests that PEoU moderately impact CT. This is further supported by the resulting significance value which is 0.000 (as < 0.05) highlighting the statistical significance of the outcome. On the other hand, the coefficient value between CT and QPA is 0.560 which is strongly positive and indicates that CT positively impact QPA. Their significant value is 0.000 which similarly shows that the outcome is statistically significant.

The results confirm that hypotheses H1, H2, H3, and H4 are supported. The direct effects of Perceived Usefulness (PU) and Perceived Ease of Use (PEoU) on Consumer Trust (CT) are significant and positive, as are the effects of Consumer Trust (CT) on QR Payment Adoption (QPA). Additionally, Consumer Trust is confirmed as a mediator, as detailed in Section 4.6.

3.16.2 Research Objective Evaluation

Table 4.14 evaluates whether the research objectives (RO1–RO4) were met, based on the findings from the hypothesis testing.

Table 3.17:Research Objective Evaluation (Section 4.7.2)

Research Objective	Description	Achieved?
RO1	To examine the impact of PU on CT in QR payment adoption.	Achieved (Supported by H1)
RO2	To assess the influence of PEoU on CT in QR payment adoption.	Achieved (Supported by H2)
RO3	To determine the relationship between CT and QR payment adoption.	Achieved (Supported by H3)
RO4	To explore the mediating role of CT in the relationship between PU, PEoU, and QR payment adoption.	Achieved (Supported by H4)

Based on Table 4.14 it has been demonstrated that the objectives of this research study have been met by testing the hypothesis by statistical tests. On the basis of the overall evaluations and the output obtained from the statistical test all research objectives (RO1–RO4) have been met, as evidenced by the hypothesis testing results. These findings align with the study's aim to investigate the role of Perceived Usefulness, Perceived Ease of Use, and Consumer Trust in QR payment adoption within SMEs in Selangor.

3.17 Summary of Findings

This section provides a summary of the key findings from data analysis and structural model assessment. The findings are categorized based on the measurement model, structural model, and hypothesis testing.

3.17.1 Measurement Model Findings

The assessment of the measurement model established the reliability and validity of the constructs:

- All constructs demonstrated high internal consistency, with Cronbach's Alpha and Composite Reliability (CR) values exceeding the threshold of 0.70.
- Convergent validity was confirmed, as the Average Variance Extracted (AVE) for all constructs

surpassed the recommended threshold of 0.50.

- Discriminant validity was established through the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio, with all HTMT values below the threshold of 0.85.

3.17.2 Structural Model Findings

The structural model assessment revealed the following results:

- The model demonstrated a good fit, with an SRMR value of 0.038 and an NFI value of 0.930.
- The R^2 values indicated moderate explanatory power for Consumer Trust (CT) (0.457) and QR Payment Adoption (QPA) (0.327).
- Path coefficients showed significant positive relationships for CT → QPA, PEoU → CT, and PU → CT which is even statistically significant, while the direct effects of PEoU and PU on QPA were not significant.
- Effect sizes (f^2) for CT → QPA, PEoU → CT, and PU → CT were medium, while the effects of PEoU and PU on QPA were negligible.
- The Q^2 values for CT (0.272) and QPA (0.226) suggested that the model has small to medium predictive relevance.

3.17.3 Mediation Analysis Findings

The mediation analysis highlighted the role of Consumer Trust (CT) as a mediator:

- CT partially mediated the relationship between PEoU and QPA, with a significant indirect effect (0.230, $p < 0.001$).
- CT partially mediated the relationship between PU and QPA, with a significant indirect effect (0.243, $p < 0.001$).
- The direct effects of PEoU → QPA and PU → QPA were not significant, further emphasizing the mediating role of CT.

3.17.4 Hypothesis Testing and Research Objectives

- All hypotheses (H1, H2, H3, and H4) were supported based on the results of the structural model assessment and mediation analysis.
- All research objectives (RO1, RO2, RO3, and RO4) were achieved, as demonstrated in Section 4.7.

In conclusion, the findings provide strong support for the reliability and validity of the measurement model, the predictive relevance of the structural model, and the mediating role of Consumer Trust in QR payment adoption.

CHAPTER 4
DISCUSSION AND CONCLUSION

4.1 Introduction

This chapter mainly seeks to synthesize the outcome of the overall research study and contextualize these findings from the wider scope of the adoption of QR payments in the retail sector of Malaysia. This has also included the alignment of the research objectives with the overall key findings that illustrate insights with a broader discussion. The roadmap of this chapter has included the summarization of the key findings with interpretations of the findings concerning the literature. In addition to these, it has been also included with a comprehensive analysis of the theoretical, policy, and practical implications to the context of the subject matter. Furthermore, the overall contribution of this research study while concerning the limitation of this study has also been recognized in this chapter. Lastly, recommendations for the prospective research and the significance of findings to a broader context have been underscored.

4.2 Summary of Key Results

In this section, the summary of the findings has been discussed to understand the critical factors that impact the adoption of QR payments in Malaysia.

5.2.1 Main results

Related to objective/question 1

The first objective and question of this research study lies in finding the impact of perceived usefulness on consumer trust in terms of QR payments. From the path coefficient in the findings, the Coefficient (Beta) value (0.434, p= 0.000) between the perceived usefulness and the consumer trust (PU → CT). These findings highlight that customers are more likely to believe and trust the payment systems that are regarded as beneficial for them. However, the coefficient value is lower than an average rank of 5 indicating that the perceived usefulness moderately impacts the consumer trust in terms of QR payments. In addition to this, it also aligns with the model of technology acceptance which further claims the perceived usefulness as the primary determinant while considering technological acceptance that promotes the QR adoption rate in Malaysia.

Related to objective/question 2

The second objective of this research study is to analyze the influence of perceived ease of use on customer trust. The coefficient value (B= 0.41, p= 0.000) between the perceived ease of use and customer trust are significant and moderately related. This highlights that the perceived ease of use moderately influences trust among customers. However, it also demonstrates that when individuals find any technology easy to use for them, they become more likely to build trust to an elevated extent towards the mechanisms. This is also seen in terms of QR payment systems adoption in Malaysia and it also reverberates in the existing literature (Hajazi et al., 2021). This posits that the simplicity and usability of the technology significantly affect the trust of the users in technology adoption.

Related to objective/question 3

The third objective is to find out the relationship between consumer trust and QR payment systems adoption in Selangor. The path coefficient and significance in the findings exhibit the beta value is 0.560 and the significance is (p) is 0.000 for CT → QPA. This indicates that there is a significant and positive relationship between consumer trust and the adoption of QR payment systems. Therefore, it highlights the fundamental role of consumer trust which acts as the mediator in QR adoption procedures. This further sustains the concept that an increase in trust levels can guide higher digital payment acceptance among the population (Namahoot & Jantasri, 2023).

Related to objective/question 4

The fourth objective is to find out consumer trust's mediating role in the association between the PEoU, PU, and QPA. Based on the results of the mediation analysis consumer trust mediated partially the association between QPA and PEoU (B=0.230, $p < 0.001$) demonstrating an indirect significant effect. Similarly, CT even mediated partially the association between QPA and PU (B= 0.243, $p < 0.001$) with a meaningful indirect impact. The direct effect of PU and PEoU on QPA lacks significant results highlighting the CT's effective mediating role (Lui et al., 2021). Therefore, it recognizes the significance of consumer trust during the gap bridging between the perceptions of the customers related to technology and actual adoption behaviors.

5.2.2 Significance of the findings and reasons

The previously mentioned findings are significant to a greater extent as these heighten the overall knowledge and understanding regarding the adoption of QR payments in Malaysia. The findings

significantly indicate that increasing both the perceived ease of use and perceived usefulness can direct a more robust trust among customers. This ultimately guides a wider adoption of QR payments in Malaysia by informing the population about its usability and simplicity. In the context of the literature, the findings have also indicated that the combination of these factors of user experience significantly increases trust in adopting technology (Ricardianto et al., 2023).

In addition to these, the demographic factors of the participants, like educational background and predominantly young highlight their keenness to use QR payment techniques as this improves the grade of their payment transactions. This further suggests that there is a readiness to adopt technical advancements specifically in financial payments or transactions. Moreover, this highlights that the providers need to concentrate on refining and facilitating ease of use to increase the practical advantages of the systems and address the demands of the demographics effectively (Sehat et al., 2024).

5.2.3 Comparison with previous research

These findings orient with the existing studies that underscore that the double role of the perceived ease of use and perceived usefulness effectively promotes trust among customers (Wistedt, 2024). It is also effective during adopting any new technologies such as the QR system. This also underscores that QR payments even contribute to financial inclusion which decreases the reliance on physical cash and fosters economic participation. Thus, increasing the ease of use and the perceived usefulness are the key factors that are more effective in building trust among the population as enhanced customer experiences in the retail settings. This indicates that these two factors are influenced in terms of affecting the adoption of the QR payment system in Malaysia. Thus, from the overall analysis, it has been captured that the perceived ease of use and perceived usefulness are the significant factors that influence the adoption of the QR payment system in Malaysia. These also influence the demographic factors and their needs highlighting that the modern population is more willing to adopt the QR payment system in Malaysia (Chong et al., 2024).

4.3 Interpretation of Findings in Relation to Literature

5.3.1 Perceived Usefulness (PU) and QR Payment Adoption

Based on the findings it has been recognized that the perceived usefulness does not significantly impact the adoption of QR payments. This is specifically evidenced by the positive and insignificant path coefficient results (B= 0.065, p= 0.212). Also, as per the TAM Perceived Usefulness is one of the determinants that influence the attitudes of the users toward new technology adoption. Therefore, perceived usefulness does directly not influence the adoption of the QR payment system rather it influences customer trust and security concerns that further influence the adoption of the QR payment system in the context (Pontoh, et al., 2022). Therefore, by mediating fundamentals of the customers like trust and financial security, perceived usefulness impacts the adoption decision significantly and positively. This is further evidenced by the association between QPA and PU (B= 0.243, $p < 0.001$) in mediation analysis. In addition, previous studies also reflect that customers become more likely to use any technology if they sense the technology as beneficial for improving transactions and productivity (Sharabati *et al.,* 2024).

The indirect impact (mediated by consumer trust) and significance of the perceived usefulness in the context of adopting a QR payment system have been attributed to numerous factors. According to the TAM, it evolves the landscape of digital payments and transaction efficiency. This further helps in improving the conventional transaction methods in a cost-effective manner and provides SMEs with an opportunity to pursue a more efficient method of transactions. These develop the adoption of QR payments

as the pivotal consideration in the businesses landscape. In addition, the higher number of respondents in this study is predominantly youthful (under 35 years, 62%). This demographic factor is more willing to sense the digital transactions' utility as they are more familiar with modern technologies and other emerging technological systems including the Internet. However, it is also a focus that perceives usefulness influences digital technology adoption but when it comes to a specific concern like QR adoption it does not significantly and directly impact its adoption. This indicates that the users or population identified the advantages of the QR payment techniques but there are possibly other external factors that weaken the direct effect of perceived usefulness on the QR payment system adoption purposes.

Possible external elements Affecting PU

The adoption of the QR payment system relies on several external factors that act as a mediator and impact the efficiency of perceived usefulness. These factors include government incentives and policies for digital payment systems, technological infrastructure, market demands, and regulatory environment (researchgate.net, 2022). These factors play a greater role in shaping the utility and perception concerning the adoption of the QR payments system in Malaysia. For instance, government initiatives such as the digital economy blueprint and the e-Tunai Rakkyat program have facilitated the adoption of digital payment methods for cashless and streamlined transactions. This further enhances the perceptions of SMEs regarding the benefits of QR payments thereby strengthening the impact of perceived usefulness.

In addition, cultural dynamics, risk perceptions, digital literacy, and trust also play a fundamental role in impacting the adoption of the QR payment system (Qadri, 2023). This provides the SMEs with the opportunity to scale up their operations in diverse areas. Hence, comprehending these considerations is critical for SMEs as it shapes their readiness to embrace innovations and technical systems in their business environments. In such a way, perceived usefulness influences the adoption of digital technologies especially the QR payment system in the context of the business landscape in Malaysia.

5.3.2 Perceived Ease of Use (PEoU) and Usability Challenges for SMEs

Usability importance in QR adoption

The perceived ease of use is another fundamental aspect introduced in the TAM framework as a significant determinant of the adoption of digital technologies adoption. However, this aspect highlights the usability of a digital technology that builds trust among consumers and drives adoption. However, there are some challenges linked to the perception comprising complicated interfaces, intuitive design blackness, technical jargon, compatibility problems, and narrow technical support. These significantly hinder the adoption and practical use of QR payment systems mainly in the business landscape of SMEs. This condition highlights that usability is one of the crucial factors especially in SMEs in promoting convenient and easy payments (Soormo et al., 2024). Therefore, there is a critical need to address those challenges to promote the usability of the new payment system in the dynamic marketplace of Malaysia.

Moreover, usability is also important for increasing the acceptance of the user with the help of a user-friendly system that can guide a higher adoption of the QR payment system in Malaysia. Additionally, within the network of the merchants, this system can enhance engagement which further aims to reduce the potential friction within the conventional payment process. The findings reveal that there is no significant association between the PEoU and the adoption of the QR payment system (B= -0.053, p= 0.232). This indicates that the PEoU mediates the usability of the digital payment system via increasing trust among the consumers. This cultural consideration needs to be comprehended for the SMEs to embrace the adoption of the digital payment system effectively and contribute to the current business landscape of Malaysia.

Technological literacy gaps

Regarding PEoU, smooth transaction procedures, and intuitive interfaces donate to the growth of promising user attitudes. Thus, to address the digital literacy gap among the SMEs several strategies need to be implemented. These include delivering easy-to-use venues for developing QR codes and interfaces with the minimal technological knowledge needed. However, by suggesting tutorials and workshops SMEs can educate small companies on QR code performance and best approaches.

As per the opinions of Zahoor et al., (2023), the managers of the SMEs often lack the expertise and skills to implement the advanced technologies. It has been also stated by the authors that the lack of technological expertise prevalent SMEs from using advanced digital technologies. Many owners of SMEs have limited technological awareness, and they do not have adequate knowledge of using technology for the improvement of the awareness. Further, many managers of the company also face issues in selecting the most suitable technology due to their limited knowledge regarding IT. Besides, the threat of cybersecurity along with the lack of technological skills are regarded as the technological literacy gaps of the SMEs.

Compared with past studies on ease of use in the context of mobile payments

Liébana-Cabanillas et al., (2020) have found that the trusts of the customers impact the PU. It has been further stated by Sari et al., (2022), that certain factors influence the ease of use concerning mobile payment. The increased number of people using mobile phones are more likely to use mobile payment. Therefore, it can be said from this literature, that mobile payment is easily used by users. It has been stated by De Luna et al., (2019), that online payment has witnessed significant growth in the past few years. Despite the lack of success in mobile payment in the initial years, a recent increase can be seen. Moreover, most of the users find it easy to use mobile payment which further helps them to save their time and also facilitates them with lots of new features which is not possible in the case of physical payment. Hence, it can be said that the PEoU and PU are high among the customers who intend to use mobile payment.

5.3.3 Role of Consumer Trust (CT) as a Mediator in the TAM Framework

Justifying trust as a weak or strong mediator

CT is considered the partial mediator in the TAM framework (0.243, $p < 0.001$). This suggests an indirect relationship in which CT acts as a partially mediated relationship between PU and QPA. If the PU increases, the CT also enhances. If the customers find it useful while using a particular technology, their trust will automatically improve. On the other hand, the CT can influence the QPA. If the CT increases the customers would be more likely to make QR payments. Further, it is also seen that CT mediated partially in the relationship between QPA and PEoU, with a prominent indirect impact (0.230, $p < 0.001$). Therefore, it can be stated from the discussion that CT indirectly impacts the relationship between QPA and PEoU and PU and QPA. Moreover, the direct impact of QPA, PEoU, PU, and QPA is not significant because of the mediator role of the CT.

Linking findings to trust-related theories in literature

As stated in the literature review chapter, the TAM acts as one of the prominent theoretical foundations concerning the understanding of user adoption in the context of the information system. It is further argued in a study, that TAM is rooted in the TRA for addressing the technology behavior in a company (Venkatesh & Davis, 2000). It has been further stated by Musa et al., (2024), that the use of the technology system by an individual is often impacted by their attitude, beliefs, and intentions. Two factors are considered in this regarding including PEoU, and PU which further shape the intention of the users to use this particular

model. Moreover, TAM theory suggests the decision of the users regarding the adoption of the technology depends on the PEoU and PU.

Further, TAM2 was introduced by Davis and Venkatesh which include the social influence procedure. As per the opinions of Milly et al., (2021), the perceived risk is considered the additional variable in the TAM theory. The TAM 2 theory also additionally consists of subjective norms, job relevance, image, and output quality. The tendency of the individual to use information technology also depends on their belief that using the particular technology would enhance their status or image. Subsequently, Venkatesh and Bala (2008) have further introduced the third edition of the TAM. In this theory, there are certain lists of other factors which impact the decision-making process of an individual. The adjustment of the PEoU is further determined with the help of the TAM 3 theory. Moreover, UTAUT consists of eight significant technology acceptance models which suggest that the use of the technology is often determined by the behavioral intention of the customers. The technology acceptance models are included in the trust-related theories in the literature review chapter.

Explaining the real-world implications

Amazon is a prominent company that uses TAM theory in its organization. As reported in a report, Amazon has used the TAM theory to comprehend the way the users of the company would use Amazon Prime (medium.com, 2023). TAM has identified perceived usability and utility as two of the most prominent determinants in the context of user acceptance concerning the new technology. Amazon has collected information regarding these issues via focus groups and surveys (medium.com, 2023). The company has also examined the data to better comprehend the way Amazon Prime was being utilized and meet all the pain points of the other companies.

Based on the data by applying TAM, the company has found that the customers considered Amazon Prime as the most helpful and useful platform as it enabled them to get access to various media materials while saving their money and time both on shipping. Hence, the TAM theory has helped Amazon to understand the habits and demands of the customers and further enhance its utilization of Amazon Prime. Uber also uses TAM to better understand their customers. It has been discussed by Moon et al., (2022), that Uber has used the TAM to understand the way users would embrace their service. It has been done before launching the applications of the Uber Taxi App. Apart from that, Netflix has also used this model to obtain customer perspectives.

4.4 Theoretical, Practical, and Policy Implications

- Expand beyond just summarizing findings—think critically about their impact

This research highlighted the key finding that impacts the likability of QR payments by small and medium businesses (SMEs) in Selangor, the retail sector in Malaysia.

Observing that key finding if QR payments implication within one chosen organization can extend well beyond it. Apart from that some individuals believe a technology use easy to learn, and they are more likely to attempt it and continue it. Users are more likely to adopt a technology if they believe it can provide significant benefits and improve their work. Trust in the technology provider and the technology itself is important for sustained adoption when dealing with sensitive data or difficult systems. The key factors include perceived ease of use, perceived usefulness, and trust that self-efficiency builds a specific positive impact on mobile payment intention (ZAINI & Sidek,2024). QR payment system based on these factors impacts the adoption intentions of users QR payment system is a capacity method to complete transactions, safety users' needs and provide a seamless experience from initiation. Technical elements

including system quality, stability, and transaction speed lead to a stronger intention to adopt the technology.

- ***How the findings influence research, industry practices, and policymaking***

Future studies identify how demographic factors including education, age, and socioeconomic background impact the perceived ease of use. Moreover, cross-cultural comparison may submit insights into how diverse societies perceive the usability of QR payments in technological readiness and also the improvement of economic infrastructure. Understanding the factors that influence PU (Perceived Usefulness) within the QR payments ecosystem is important for policymakers, economic industry, and technology developers to cross-sectional design individual-centric solutions that facilitate adoptions (Tajudeen *et al.,* 2025). The usability and ease of use of QR payment systems have an impact on adoption choices. The key finding of this research study can influence all parties in efforts to boost digital adoption among retail SMEs. Policymakers can learn which attributes to highlight when developing programs that facilitate QR payment adoption. The findings of this study provide legislative recommendations for policymakers to focus on refining future government within this subsector. Technology implication strategies mention that considers both traditional factors and context variables investigated in the research. The finning can be disseminated to policymakers, practitioners in the economic service industry, and adopters. Apart from that it allows that allows informed policies and implementation depending on the practical realities faced by retail SMEs in Malaysia. The key factors including PU and its impact on policymakers, could concentrate on developing targeted awareness and training programs that effectively show the practical advantages of QR payment. For example, expedited checkout process and increased transaction records. Moreover, the bank industry and FinTech providers can collaborate to optimize the system that highlights the impact of the regular operations of SMEs and increases perceived usefulness (Gan *et al.,2023*). The efficiency of the QR payment system depends upon system quality, user-centric design, and faster transaction speed. All factors influence user satisfaction and trust probability of the adoption. Studies for us to identify design features that drive ease of use including involuntary interfaces and clear infrastructure. Researchers use models like technology acceptance models to study how these factors interact with service adoption behaviors. Industries incorporated user-centered designing principles focus on clear value propositions and priorities on building trust through transparent communication to enhance adoption rate.

4.4.1 Theoretical Implications

Contribution to the Technology Acceptance Model (TAM) by integrating trust as a mediator.

The Technology Acceptance Model is a theoretical framework that explains the process of users accepting and using new technologies. The technology acceptance model (TAM) was widely used by the business to understand the acceptability of the technology by the users. The main aspect of TAM was its benefits and usefulness in technological adaptation where it was focused on extracting useful and valuable information regarding the primary determination of technological adoption. However, the integration of the human behavioral aspect which is trust with the role of mediator significantly enhances the model's expected implementation capabilities most importantly in the context of the QR payment system.

The conducted Path Coefficient Analysis results in a suitable relationship between the variables of consumer trust and the QR payment adaptation. This indicates that there is a strong connection between the adaptation of QR payment and the trust of the consumers. The consumer has a higher rate on the QR payment method but as a moderator, this correlation value was slightly decreased. The trust of the consumers was referred to as their confidence level in the aspect of security and reliability of the QR

payment method. Not only the method of payment but also the organization that provides those services are connected to the trust of the consumers. By incorporating trust, TAM was able to help the consumers acknowledge the decisions of the users about the adaptation of QR payment. Those decisions are not only based on efficiency and simplicity but also on the trust and belief of the consumers that the QR payment system is safe and dependable. Particularly, the long-term use of the payment system is deeply rooted in the behavior of the consumers. The trust of consumers affects the individual interest of the consumers in adopting electronic payments like QR codes (researchgate.net, 2021). This particular integration of consumer trust and the QR payment properly aligns with the increasing attention on digital security in the current financial technology landscape.

The conducted research and findings indicate that trust can significantly affect the variable's perceived ease of use and the perceived ease of usefulness of their QR payment technology. This indicates that when the customers trust the payment system, that re predetermined in its easy to use and beneficial. This also increased their effect towards using and adopting this system. Thus, it can be stated that the trust of the consumers acts as a critical mediator that can increase the validity of TAM in understanding the customer's adoptive behavior towards technology. In addition, top that, the integration process of trust and TAM highlights the importance of maintaining the trust level of customers by taking effective security measurements, policies, and reliable digital performance. In this process, the financial institutions can give more priority to multiple trust-building activities to improve the digital payment adaptation.

Implications for digital payment and behavioral finance theories.

Behavioral finance theory was very much separated from traditional economic theories. However, it was part of the economic theory which was used to explain the irrational financial decisions and behavioral aspects of the people such as high spending on credit cards and panic selling of market shares and downfall. In this research, behavioral finance uses multiple aspects of financial physiology to analyze the actions of customers in using and adopting digital payment methods, especially the QR payment system.

The connection and integration of trust into the Technology Acceptance Model have made significant efforts to understand the correlation between digital payment and behavioral finance theory. In the current era of digital payment, trust is one of the key factors in the adoption and use of digital payment methods. The trust of the consumers can increase or decrease which also affects the adoption process of new payment technology in a similar way. For this, the understanding of the effect and influence of trust in the behavior of the user can provide valuable information on the relation between consumer tract and digital payment system.

Digital payment systems such as QR payments depend heavily on the trust level of the users because of the financial risk associated with it. In order to fully adopt digital payment systems, users must trust that their personal and financial information is safe and secured by respected financial institutions. Those trust aspects of the digital payment user can be described with the help of behavioral finance theory where the barriers and the influential factors are going to be easily highlighted.

The behavioral finance theory describes that the digital payment usage of people has a direct relation with their intentions. This indicates that the intention is a primary predictor or decider of the adaptive behavior of the people. This intention was further influenced by multiple factors such as attitude, sub-norms, and behavior control aspects. Among the behavioral factors, there is also trust which affects the user's viewpoint of risk and willingness, creating a suitable balance in their mind. By incorporating the trust of the users in the behavioral finance model, it was assumed to develop or identify a more natural pattern related to user behavior and preference in the climate of digital payments.

Perceived behavior control was stated as the perceptions of individuals about their ability to function in a particular adaptive behavior (sciencedirect.com, 2025). That behavioral aspect was initiated through multiple considerations of their access to a sufficient resource, available skills, and self-confidence in mitigating potential challenges. At a particular time, when individuals believe in their ability to control the unpredictable situation over the action, they are more encouraged to follow their behavior which aligns with self-intention. This similar behavioral situation was occurring in the time of using the digital payment options by the users. For instance, when individuals possess a strong ability to control their payments and digital payment platforms, there is a high chance of connecting intention and trust for a well-planned digital transaction. This particular behavioral approach of digital payment users can lead to a higher adaptation rate of the net payment methods which in the end leads to boosting the field of digital platforms and behavioral finance.

The need for a modified TAM framework that includes security, trust, and SME constraints.

The traditional technology acceptance model was overly easy and simplified because of its direct focus on only two factors which are perceived usefulness and perceived ease of use. However, the traditional TAM neglects multiple important factors such as cost, social influence, and the operational efficiency of the side factors (digital platforms) (astesj.com, 2020). In complex situations. The TAM framework was very ineffective and may not fully capture the complexities rated to the adaptation of technology especially for the small and medium-size enterprises. Through the use of traditional TAM methods, SMEs face unique challenges and difficulties which can create problems for decision-making. In this process, a well-modified TAM framework is going to be necessary for maintaining operational security, and user trust, and decreasing SME constraints.

For digital payment methods such as QR payment, security is the most critical factor for the users and the SMEs. The sample and medium enterprises often lack the affordability to implement advanced digital security measurements just like a normal user. This makes them vulnerable to outside threats and places higher risk in their financial aspect. In this process, the TAM framework can be integrated with additional security concerns, and the understanding of the impact of security concerns in SME adaptation can be increased significantly. This modification can be done through the implementation of the security variable or variables in the normal TAM framework. This modification approach directly highlights the need for acceptable and affordable security solutions for digital payment methods.

In the earlier discussion, it was stated that the trust of individual users is a critical mediator that directly influences the adaptation of technology. This was similar for the SMEs because maintaining and improving trust among the customers was essential for the successful implication of the QR payment procedure. The trust of the customers or digital platform users very much correlated to the improvement efforts of SMEs towards improving payment procedures such as security and efficiency. On the other hand, customers have to trust digital payment platforms to maintain the security and privacy of their financial data. For this reason, the modified TAM framework should include the importance of consumer trust-building activities with the maintenance of security standards.

The implication of the SME constraints in the modified TAM framework is able to acknowledge the challenges that those enterprises face in the technological adaptations such as effective financial resource allocation, and lack of technical expertise. Enterprises also face difficulties in the procedure of digital payments where it can be difficult to track and deal with multiple payments. By addressing those constraints, the modified TAM framework provides a more accurate and relatable understanding of the factors that influence the adoption of the QR payment method among SMEs. In the final statement, the

modified TAM framework which includes the security, trust, and SME constraints can present some valuable insights that were objected to promoting the adaptation of the digital payment system.

4.4.2 Practical Implications

For Policymakers

Recommendations for national digital payment policies to enhance SME adoption

SMEs play a very important role in the online payment system by moving innovation and promoting competition, and this system also helps to improve financial inclusion.

To improve the SME system in digital payment in Malaysia, the following recommendations are discussed below:

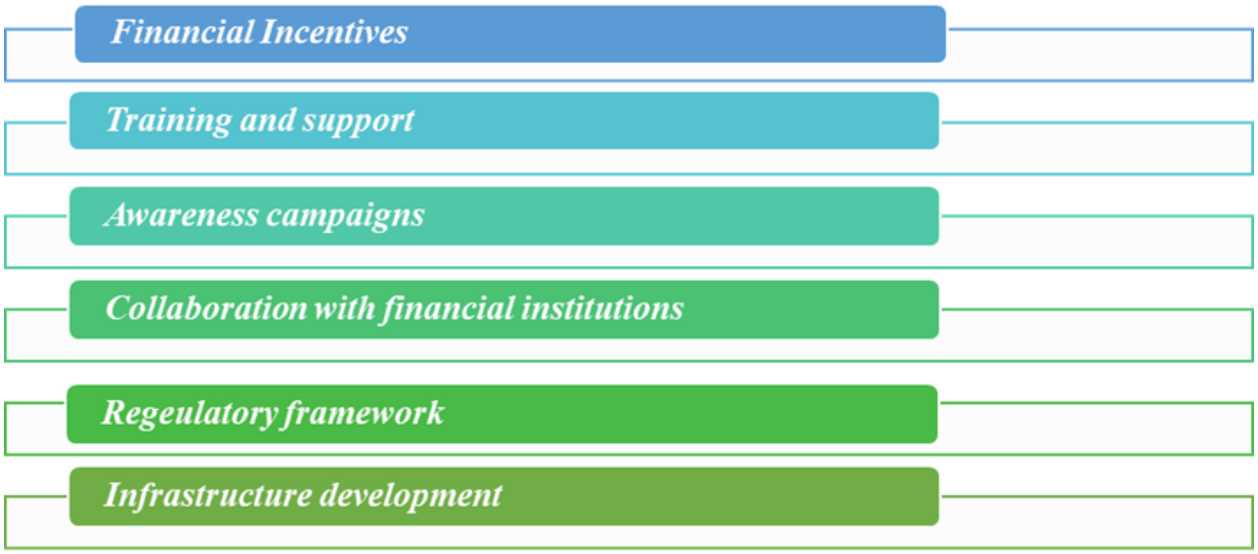


Figure 5.1: National digital payment policies

(Figure: self-developed)

Financial Incentives: this system provides tax breaks, subsidies, and grants to SMEs that help to adopt a digital payment system. However, this system helps to reduce the financial businesses to adjust to digital payment systems (Alzoubi et al., 2022).

Training and support: presenting a training program and technical support to help the SMEs understand and effectively use the digital payment system (Alita Sharon, 2025). This process is able to induce a new workshop, online tutorials, and committed helplines.

Awareness campaigns: the Malaysian government has to launch country-wide campaigns to build awareness about the benefits of digital payment, such as improved efficiency, reduced money transaction costs, and enhanced money-related securities. Therefore, the e-Duties cabins by the Bank of Negar Malaysia are a better example for conducting awareness campaigns.

Collaboration with financial institutions: The Malaysian government has to collaborate with banks and financial educational hubs to develop user-friendly digital payment keys tailored to the needs of SMEs. This approach is able to include mobile payment apps, point-of-sale systems, and online banking systems.

Regular framework: Governments have to establish a clear, regular framework that helps to ensure the online security and trustworthiness of digital payment systems (digitalnewsasia.com, 2023). Developing trust with SMEs and encouraging them to adopt the digital payment system.

Infrastructure development: The research bodies have to invest in important infrastructure such as high-speed internet and relatable payment gateways, which help to provide support to the overall adoption of the digital payments system.

- The role of government regulations in building trust (e.g., cybersecurity measures, consumer protection laws).

The below-mentioned regulations of Cybersecurity measures and consumer protection laws not only provide customer protection and business but also promote a stable and trustworthy culture for economic activities in Malaysia.

Cybersecurity measures

The national cyber security agency launched a strategy to improve Malaysia's stability against cyber threats. Therefore, the Cyber Security Act 2024 set a milestone of the degree that helps to develop the power for Malaysia's cyber defiance (pwc.com 2024). Throughout the outline, the roles and responsibilities of national critical information infrastructure entities and cybersecurity services are provided. This Act is able to ensure that critical sectors such as transport, banking, and healthcare make strict cybersecurity standards (Mishra et al., 2022). On the other hand, this process also protects a piece of sensitive information and maintains public trust in the digital service.

Consumer protection laws

The Consumer Protection Act 1999 is the keystone of customer rights in Malaysia. This Act provides a complete prediction against lying and deceptive approaches, unsafe products, and unfair contract terms. The CPA helps to ensure that the business is stuck to high standards in transparency and accountability, which generally helps to build customer confidence in the marketplace (nacsa.gov 2025). On the other hand, the lemon law is generally introduced under the CPA law, which allows customers to return unsatisfactory products within six months for a refundable repair and replacement, which helps to improve customer trust.

- Addressing the digital divide between large firms and SMEs in Malaysia.

The digital divide between large firms along with small and medium enterprises in Malaysia is an important issue that is able to impact the country’s economic growth and overall competitiveness. Large firms usually have the good resources and infrastructure to adopt digital technology. Therefore, SMEs face multiple challenges that make a cause for restricting their digital transformation (smecorp.gov 2021).

For SMEs, one of the key challenges is making preparations to adopt digitalization, which is a very complex system that is also costly and unnecessary. The multiple SMEs face a lack of financial and human capital needed to invest in advanced technology such as the Internet of Things (IoT), cloud computing, and data analytics. In addition, digital information in Malaysia is not fully developing there is very limited access to relatable and super-fast broadband services (Saluja et al., 2023). This lack of connectivity is also deepened by the digital divide.

Governments and policy interventions are important for addressing the challenges. The enterprises, such as improving the quality and affordability of broadband services, help to promote digital entrepreneurship and provide capital access, which is able to overcome the gap between large firms and SMEs. As an example, the Malaysian government has implemented multiple programs to support SMEs' digitalization, but this needs to be done to ensure that these efforts are effectively sustainable.

For Financial Institutions & FinTech Providers,

- How banks and fintech firms can enhance trust through transparency and security features.

The banks and fintech firms in Malaysia can improve trust by providing transparency and security features

by adopting multiple key planning (Yusoff et al., 2022). Transparent communication is important for the financial educational hubs to provide clear and straightforward information about their services, fees, and policies. Transparency and accountability include any kind of potential risks and how they are mitigated.
After that, a strong cyber security measure is necessary. Establishes advanced encryption technology, multi-factor authentication, and regular security updates is able to help the customer protect data and develop trust (iresearchservices.com 2024). In addition, keeping with data protection laws and regulations to ensure that the customer information is handled responsibly.
Moreover, the personalized customer has the experience of promoting trust. By using data analytics and AI, the banks and fintech firms are provided a solution that will help to meet individual needs. This not only helps to improve customer satisfaction but also shows a commitment to helping the customer's best interests.
Therefore, ethical approaches play a very important role in developing trust. The financial and educational hub has to go for high ethical standards, which helps to avoid biased practices and promote corporate social responsibility (mdpi.com 2023). This practice helps to be transparent about how the customer's data is used and provides options for customers to opt out of data collection.
Apart from that, continued innovation is the key to maintaining trust by staying forward from technological advancement and continuously improving their services. The banks and fintech firms are able to show their overall commitment to delivering secure and efficient financial salutations.

- The importance of financial literacy programs for SMEs to increase adoption.

The financial literacy program is very important for SMEs in Malaysia as they are playing a significant role in the country’s economy. This system is able to make national income, creating job opportunities and wiping both local and overseas markets. These programs are able to help entrepreneurs manage financial matters effectively, which is necessary for the country's business survival and overall growth (duitnow.my 2021).
In Malaysia, the government as multiple organizations have to encourage the importance of financial literacy for SMEs, and it has had to establish multiple initiatives to improve it. As an example, the National Strategy for Financial Literacy 2019-2023 is generally sought to improve the access the financial management information, tools, and resources, and teach positive fiscal behavior to the targeted groups. This strategy is mainly designed to empower SMEs to make sound strong financial decisions that help to manage personal savings and expenses, make investments wisely, and borrow responsibly.
After that, the research has shown that financial literacy developed a serious impact on the success and failure of enterprise management which mainly belongs to the young enraptures. A study able to conduct on the level of financial literacy with the general participants of an entrepreneur development program in Malaysia found that it has many SME players work is still lack financial knowledge (fintechnews.my 2025). This helps to highlight the need for continuous education and training in financial management to ensure the sustainability and growth of SMEs.

- Development of incentive programs (e.g., lower transaction fees, government grants) to encourage QR payment use.

In Malaysia, the government and the financial educational hubs have been actively encouraging the QR payments system through the multiple motivational programmed by the payments network Malaysia SD Bhd (pay net) for collaboration with the TNG digital (ijastre.org 2023). This collaboration program offers incentives to the first 2,000 retailers who are successfully registered in the Touch and Go wallet system.

Lower transaction fees

The governments have to reduce or remove the QR transaction fees for the payment. It is able to more attractive for the customer and merchants. For example, the government has to offer zero or a very minimal fee for QR transduction, a very low or a certain amount is able to encourage small businesses and customers to switch to the QR payment method.

Governments Grants

Providing Grants to small and medium-sized enterprises SMEs to update their payment system and accept QR payments is able to help in increasing the adoption. This Grant is helping to cover the cost of hardware and software needed to facilitate the QR payments (Goingdigital.oecd, 2025).

Tax incentives

The Malaysian government has to offer tax deductions or rebates to the businesses that help to adopt the QR payments system to incentivize them to snake the switch. This tax incentive is able to help with the initial costs of implementing QR payment systems.

Public awareness campaigns

Conducting multiple campaigns to educate the public about the benefits of digital QR payments such as convenience security, and speed is necessary to improve customer confidence and usage.

Collaborating with financial institution

Make collaboration with the banks and payment services mobile apps who provide offer rewards and cashback for using QR payments. This process helps to motivate the users to use the QR payment system more frequently.

Interaction with the government services

Promoting Malaysian residents to use the QR payment system for multiple government services, such as bill payments and public transport which is able to improve the familiarity and develop trust in QR payment systems.

Support from innovation

The Malaysian government has to provide funding to and support for startups and fintech companies which helps to develop an innovative QR payment system it is able to drive technological advancement and improve the overall digital payment ecosystem.

For SMEs and Retail Businesses

- How SMEs can overcome trust and usability barriers in adopting QR payments.

Small and medium-sized enterprises in Malaysia are able to overcome the trust and usability barriers in adopting the QR payment system by establishing multiple strategies, which are mentioned below:

Education and awareness The Malaysian governments have to conduct multiple workshops and training programs to educate the SEM owners and their employees about the benefits of the functionality of the QR payment method. This process has the pronation to provide help to relieve friars and misunderstandings about the technology.

Security measures

They have to ensure that the is a very strong point about the security measures in the palace to protect transactions. This process includes using encryption, and secure QR codes. Therefore, the government has to educate the customer on how to verify the authenticity of QR codes.

User-friendly interface

The government has to make a user-friendly and easy-to-use interface for QR payment systems. Moreover, they have to simplify the process it is able to encourage both SMEs and customers to adopt the QR payment technology.

Motivation and support

Provide motivation such as reducing the QR transaction fees and conduit multiple promotional offers for using the QR payments. In addition, the governments have to provide technical support to SMEs for troubleshooting any kind of issues they encounter.

Customer feedback

The online transition system has to gather feedback data regularly and analyze the feedback from the customers to identify the pain points and areas for improvement. This approach is able to help in making necessary adjustments to improve the usability

Promotion and marketing

An active promotion of the use of QR payments through marketing campaigns helps to highlight the comfort and security of the system. The success stories and references for the other SMEs are able to build trust.

- Strategies for training employees and customers on digital transactions.

Training employees and customers on digital transactions is very important for businesses in Malaysia to stay competitive and ensure the smooth smooth operations. Here is some planning is discussed below:

For employees

Comprehensive training programs: Develop a properly structured training culture program that helps to cover the basics of digital transactions, cyber security, and the use of particular tools and performs. This approach helps to include workshops, online courses, and hands-on practice sessions.

Regular updates: Keep the employees updated with the latest tests trends and technology in the digital transaction system. This process can be done through regular training sessions, newsletters, and wieners.

Mentorship program: Pair less tech-savvy employees with tech-savvy mentors who are able to provide guidance and support as they learn to navigate the overall digital transaction.

Incentives and rewards system: The SMEs have to motivate the employees by the offering the incentives and provide rewards for amok successfully completing training programs and dementing proficiency in the digital transactions.

For customers

User-friendly guides: develop easy-to-understand guides and tutorials that are expiring that heap to perfumed digital transactions. This practice can be made by the video format, informatics, and step-by-step instructions.

Customer support: providing strong customer support through multiple channels such as phone, emails, chatbots, and social media to assist customers with any issues they encounter during the digital transaction.

Feedback mechanism: The digital traction system has to establish a feedback mechanism to gather the understanding of the customers about their experiences with digital transactions. Using this feedback system, it helps to improve the training materials and support services.

Interactive workshop: They have to organize workshops and webinars where the customers are able to learn about digital transactions in a hands-on background and ask questions in real-time time.

- The impact of QR adoption on business competitiveness and revenue growth.

Improve the customer experience: established QR cords are able to streamline the transactions, making them faster and more convenient for the customer. This is able to guide the customer satisfaction and loyalty test.

Expand market reach: The QR cords with a unique design are used in market camping to attract new customers. By offering promotions and discounts in the QR codes, and their process, the business is able to reach a very wide audience and boost the sales drive.

Improve operational efficiency: QR codes help businesses automate the transaction process and reduce manual errors. This is able to lead to cost savings and improved efficiency, which helps to allow the business to focus on growth initiatives.

Data analysis: The QR codes are able to provide valuable data on customer behavior and preferences. By analyzing this data, the business is able to make information decisions and tailor its offering to meet the customer needs.

Stay competitive: in the competition, the maximum number of businesses are adopting the QR system that helps to stay forward. Investing in the new QR technology and improvising the user experience is able to improve the user's overall experience

4.5 Contributions of the Study

Figure 5.2: Contributions of the Study

(Source: Self-developed)

- ***How the research fills gaps in the literature (especially regarding trust as a mediator).***

The research study regards Trust a s mediator in QR payment adoption among SMEs in Selangor, Malaysia. This fills gaps in the TAM literature by enhancing financial limitations. This research study should focus on filling the gap, the factors as a mediator between perceived usefulness and perceived ease of regarding intention to accept. To fill the gaps, research should explore the applicability of the technology acceptance models to emerging technologies including (AI) artificial intelligence and blockchain systems. Traditional technology appetence models require substantial modification to adequately capture the specific characteristics of decentralized processes (Theodorakopoulos, *et al.* 2024). Increase investigation

of post-adoption behavior and system continuance. Boosting to understanding of technology acceptance in emerging technological paradigms. Need an understanding knowledge that how patterns of technological acceptance evolve over time. Developing contact-specific extensions of TAM while preserving theoretical parsimony.

- ***Provide empirical evidence supporting digital payment adoption theories.***

An emerging market where digital payment adoption is still developing trust regard is complex due to the potential risks. This study on mobile payment adoption found that perceived security significantly predicted consumers' intention to use digital payment systems. It highlights the importance of trust in contributing to digital payment adoption. Researchers have found that building through transparent possess are faster security measures is an important emerging marking where digital payment adoption may be hindered by regard to data privacy.

Positive correlation between trust and adoption

This research study found a positive relationship between the level of trust in SMEs in Selangor, Malaysia. It has a QR payment system and its likelihood of adopting it mentions trust is a key contributor of behavior intention to use the technology.

Impact on perceive benefits

SMEs are more likely to recognize and value potential benefits when they highlight a high level of trust in the QR payment system (Shekhar,2021). Key benefits include faster transactions, minimized transaction costs, and improved consumer experience, which leads to increased adoption.

Security concerns mitigated by trust

Research emphasis that trusts plays an important in overcoming anxieties concerning data privacy and potential fraud related to digital payment systems. Especially for SMEs in Selangor, Malaysia.

Trust is a major barrier

This research demonstrates that SMEs in Selangor are sometimes hesitant to adopt digital payments due to concerns about data security and fraud which means that building trust in the system is essential for adoption.

Impact of Government Initiatives

Malaysian government-led campaigns promoting digital adoption and providing support for SMEs to integrate this system have been demonstrated to positively impact trust and adoption rates in Selangor.

This research study exploring the impact of a pandemic on QR payment adoption emphasizes that trust in technology played an essential role in encouraging its use. Apart from that especially, SMEs are concerned about hygiene and physical contact during transactions.

The empirical evidence suggests that to promote digital payment adoption among SMEs in Selangor, a focus on building trust through security measures clear communication, and mentioning concerns related to ease of use is important. Apart from that aligns with the principle of the technology acceptance model.

- ***Contribution to Malaysia's cashless economy goals.***

The trend to transition to digital payment is occurring as well with government policy development paying the way for a cashless society and technological integration around the ground in Malaysia. To contribute to Malaysia's cashless economy goals through QR payment, businesses and policymakers, focus on enhancing trust m security, and ease of use. Apart from that by prompting QR payment adoption through public awareness campaigns, collaborating with financial organizations to integrate QR functionalities into existing baking apps, and faster security measures that foster QR payment usage (Amirrudin, *et al.,*2024). It effectively addresses concerns around data privacy and digital literary gaps to encourage

acceptance among the population in Malaysia. SME retail sector adopting QR payment through standardized implementation the nation realistically achieves a cashless society. The government in Malaysia implements financial literacy programs to educate consumers about digital payment safety, fraud awareness, and secure transaction processes and practices. Implementing a secure identity solution can reduce fraud risks regarding the safety of digital transactions that encourage long-term confidence in cashless payment solutions. The significance of QR digital adoption extends beyond merely facilitating cashless transactions. QR payment system shows that advantage in the digital financial landscape specifically in the emerging market of Malaysia where cashless transactions are experiencing faster growth. QR payment system facilitates border access to digital financial services that encourage economic participation when consumers are satisfied with it. QR payments are essential to enhance financial security and trust within the digital payment ecosystem. A well-informed consumer base is more appropriate to attract digital payment technologies confidently, thereby increasing adoption rates. Malaysian government agencies are collaborating to implement cybersecurity awareness campaigns that lead to best practices. It provides individuals with an understanding of how to protect themselves from dishonest activities. Government policy that ensures that trust is a part of the solution through daily oversight, consumer protection, and informational programs efforts that emphasize the feasibility of QR systems and contribute to Malaysia's cashless economy goals.

4.6 Limitations of the Study

- ***Methodological constraints (e.g., self-reported data, potential bias)***

This research methodology constraint includes self-reported data, and potential bias which are a limitation of this specific study. This research adopts a quantitative approach while generating study findings for a wider population. Participial may provide answers they believe are socially acceptable even if they do not accurately reflect their opinions. That led to over-reporting of under-reporting of negative ones. For example, the limitation of this study including potential bias also highlighted that the factors of trust and adoption of QR payment need investigation with the mediator of trust between perceived values, perceived usefulness, and QR digital payment adoption. This study is based on a design of cross-sectional that collates data in time. This methodological issue deals with the relationship between variables and does not lead to opportunities to consider the long-term influence of the adoption of QR payment. This method does not allow to crate of a causal relationship [and to study the long-run effects of trust on QR digital payment adoption. Quantitative data provide a general picture of patterns and trends but do not provide a deep understanding of the individual experience, decision-making, and perceptions of consumers. Self-reporting measures are used in social science research that negatively influence the accuracy and reliability of the collected information. Participants may start answering the survey question, trying to present themselves in a good light to what they believe to be socially acceptable.

- ***Scope limitations (e.g., findings specific to Selangor, not generalizable to other states)***

This research limitation highlighted the geographical area of Selangor in Malaysia is not generalizable to other states. Although Selangor is a specific economic hub in the country of Malaysia that hosts a high number of SMEs the results may not be applicable to the other states within the country. SMEs in many regions may present specific challenges that might impact their acceptance of QR payment technology. As a result, future studies could identify trust as a mediating factor of QR payment adoption in the retail sector of SEMs in other states or locations to have a good understanding of the phenomenon.

- ***Technological and market limitations affect adoption rates***

One of the critical limitations remains the inconsistence adoption of DuitNow QR payment among SMEs, various of whom cite high setup budgets and a lack of technical support as barriers. Moreover, regulators consider the difficulties of fee structure and, cybersecurity level readiness among SMEs. and training availability to facilitate the transition of QR payments. For example, perceived ease of use, personal innovativeness, and social influence can affect consumer attitudes and behavior toward QR payment. QR codes can only store a limited amount of information that is not sufficient for complex applications. QR codes can be susceptible to attacks if not encrypted leading to concern about data security an individual trust.

Critically discuss study limitations beyond just sample size.

The descriptive analysis was used to evaluate the relationship between the research variables however, the particular method of analysis was not very suitable as it doesn't present any direct answers related to the research question. In this process, Hypothetical analysis was more suitable and appropriate. The cause-of-effect relationship is not properly discussed in the results of the results of descriptive analysis. Another limitation of the conducted research was the lack of studies related to the previous research. The behavioral aspect of digital payment users is not fully described, including the new technology related to QR payments. The relevant factors that affect the outcome of the research result are the limited access and use of the available data. The data was gathered through a suitable data collection method. However, it was not ensured to be fully accurate or reliable, which implies creating obligations about the results and conclusion.

The time constraint was another aspect that the research needed to focus on. The additional data analytics procedures used in the research are very complex and time-consuming. This complexity of the data analysis procedure can create issues for the nonrelated viewer to understand. This can also increase the chance of errors in results and the decisions of the results.

4.7 Future Research Directions

Extend the study beyond Selangor to include nationwide data.

The implication of trust as a mediator of payment in international scenarios shows a vivid result under differences in nationality. The market analysis of Vietnam has indicated factors like personal innovation, perceived security and usefulness, perceived ease of use, and fascinating conditions affecting attitudes toward the use of QR code payment services (Ngo & Nguyen, 2021). The implication of QR as a trusted option for payment has indicated positive trends in the behavioral intention of Bangladesh natives. The positive image related to QR code and trust has influenced the perceived value and trust, whereas the impact of attitude is minimal. There has been an indication of a spatially imitated relationship between local perception and their propensity to accept QR code payments (Ashrafin & Easmin, 2023). The implication and adoption of the QR payment option in Sri Lanka have been undertaken through the use of a unified theory of acceptance and the use of technology. The implication of QR codes has indicated perceived satisfaction in the use of QR codes with a perceived satisfaction in its recommendation (Hewawasam et al., 2022). However, the indirect use of QR codes with perceived satisfaction did not have a direct impact on the recommendation regarding the use of QR for payment options.

Conduct longitudinal studies to observe changes in SME adoption over time.

The QR payment options in Malaysia have indicated more affordable options for payments as compared to traditional POS systems. This mode of payment presents a typically major advantage option for SMEs. however, the perceived ease for the use of QR codes as payment options and a change in the inclination among the customer base have been noticed. The general factor is the difference in the perceived value of

use and the perceived security risk involved in payment options (Wong, (2023)). An important factor influencing the consideration in the use of QR adoption is the standardized option process DuitNow QR as the standard mode for online payment. The implication of "DuitNow QR" payment is managed through Network Malaysia (PayNet) enabling single QR code users to pay with various e-wallets and banking apps. The other perceived factors in consideration of QR code acceptability are cost-effectiveness and increased accessibility. The priority factors are favorably perceived due to lower transactional fees; however, the factors of accessibility have shown a mixed reception due to a perceived risk of safety with convenience. The data collection methods involve the use of an online survey, with an interview with 200 respondents with the primary survey. The analysis for the category of SMEs accepting QR data is the use of statistical surveys. An important consideration for SMEs in the adoption of QR codes through Longitudinal studies panel attrition rate for managing the participant's group out rates and quality of data for checking the accuracy and consistency of data have been considered.

Investigate other mediating variables, such as government incentives or financial literacy

The use of mediating variables in the form of establishing financial literacy in five-stage strategic planning. The first part involves the nurturing value of online payment and translation through financial education in co-curriculum. The next part is the financial information access to others through informative tools and resources. The third part is the inoculation of positive reactions towards financial transactions through imparting positive knowledge behavior, fostering good money management, and encouraging business sustainability (fenetwork.my. 2023). The other two categories of key factors are boosting long-term financial, and retirement plans and policy.

Explore alternative digital payment methods, such as blockchain-based solutions

In Malaysia, there is a variety of digital payment methods like digital wallets, Bank transfers, cards, contactless payment and buy now pay later. Digital wallets are one of the most favored digital payment options with an internet penetration rate of 90.2%, this has mainly gained popularity due to government initiatives to promote online payment. The process of bank transfer is the medium of payment where money from one account to another account is transferred (Hassan et al., (2021)). There are various methods of bank transfer utilized in Malaysia which are DuitNow, FPX an internet-based payment gateway, and telegraphic transfer which cross-border payment method is used for personal remittance and business translation. The final mode of payment is through the use of SWIFT a unique outliner for payments from worldwide. The other form of contactless payment is through the use of credit cards at cashier counters through the use of Visa contactless, mobile payment options. There are also other payments used like Billplz, HitPay, GHL, and Bizapay. The last option for analysis is buy now pay later is an option that allows customers to buy items at a time and pay at a later time (stripe.com. 2024). The BNPL plan's first work is choosing a payment option, creating of account, selecting of repayment plan, and purchasing and paying installment prices

4.8 Conclusion

Discussing the result of identifying the research questions and objects with key findings. This study mainly highlighted the importance of QR payment adoption among the SME retail sector in Selangor, Malaysia. This research illustrates the key factors affecting the likability of QR payment. This research chapter also recognized the weakness of the study and suggested the research gaps. This research focuses on the QR payment system as a new mobile payment technology. QR code emerging as an effective use of this technique of mobile transaction enabling, specifically in Malaysia. Providing the result of the trust and acceptance of this significant technology among various consumers.

SMEs are a central point of the Malaysian economy. It is vital for local job perspective here consumers also engage. QR payment for retail sector SMEs that necessary enhancements depend on concern in each industry to provide improvement. Financial institutions significantly boost the perceived ease of the QR payment system. The financial institution can manage financial offerings to set retail and SME requirements. In addition, public-private partnerships developed to create new digital payment literacy campaigns that educate consumers and also businesses on the use of QR payment. Malaysian policymakers focus on refining future governmental within the sub-sector, the policy suggests enhancing financial literacy and cybersecurity awareness campaigns for SMEs.

QR codes are likely as a standard payment method for SME retail sectors due to their ease-of-use barrier to entry for business. the capacity of QR payment operational that improves consumer engagement and stimulates socio-economic development. By exploring trust's mediator adoption variable this work offers practical insights toward a sustainable future.

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