

Abstract

The covid-19 pandemic has disrupted society in numerous ways, and one of these intrinsic changes has been the increasing adoption of QR code payments. The food and beverage industry, especially the restaurant sector is one of the most disrupted services. The findings in this paper show that restaurants are among the top adopting industries of QR code payments effecting both consumers and merchants. The paper reports research on the adoption of QR code payment behaviours among consumers and merchants in restaurants. This is one of the first studies to propose a systematic mapping in this topic. There is limited literature on QR code payments deployed within the food and beverage industry during post-COVID-19. The study has found a knowledge gap in the literature on the post-COVID-19 QR code payments. In a survey of 501 academic journals in the field of QR code payment in restaurants, 76 articles met the criteria for inclusion and exclusion as defined in the study. This study extracted 76 related studies from two highly regarded databases and identified the factors that impacted adoption.

Keywords: Covid-19 impact, QR code payments, Food and Beverage industry, Restaurants

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We appreciate the time and effort that reviewers dedicated to providing feedback on our development paper and we are grateful for the insightful comments which brought valuable improvements to the paper and for further research. We have incorporated most of the suggestions made by the reviewers and the paper constituted first stage of further research on a complex in-depth investigation of QR code payment in restaurants from merchants perspective.

1. INTRODUCTION

In December 2019, a new virus spread around the globe impacting on millions of people lives (Tai et al., 2021). This unprecedented pandemic brought radical changes to the ways in which people perform and manage their transaction behaviours (Zhong and Moon, 2022). Moreover, the COVID-19 pandemic has brought the payment industry into a “new normal,” escalating the deployment of digital payments (Khando et al., 2022) with QR code mobile payment technology thus increasing popularity (Türker et al., 2022) and fast-changing the technology adoption behaviours among consumers and merchants (Iskender et al., 2022b).

Additionally, there has been a rise in the usage of QR Code payments technology since the implementation of the check-in process in public domains such as the NHS track-and-trace (Juniper, 2021). This service was used to control the outbreak and this rise in adoption can be seen in Figure 1. It is noted that this method of tracking social interactions has impacted the adoption of the QR code payment system, and increasing usage in the UK and other Western markets (Juniper, 2021).

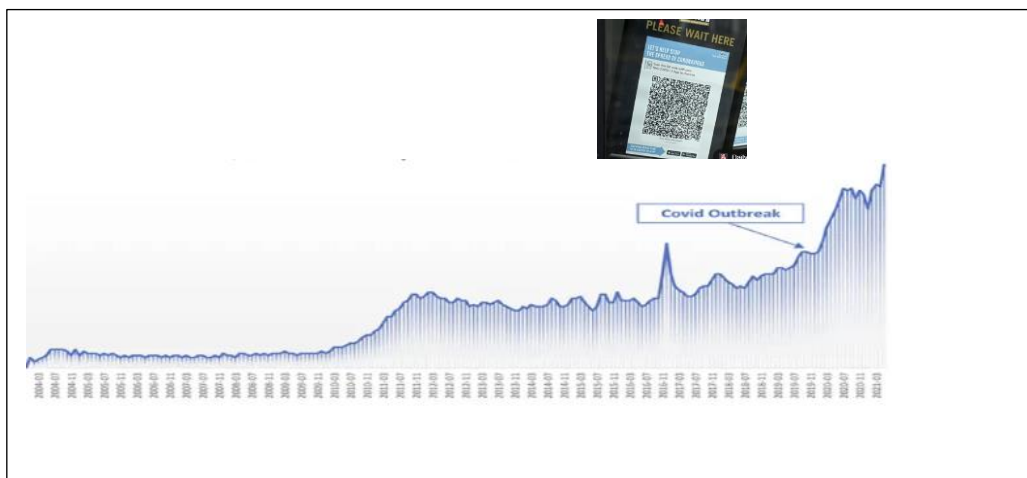


Figure 1. Author adoption of Juniper Research QR Code usage rises due to Covid-19

Furthermore, many restaurants across the United Kingdom have faced an increase in the adoption of Cloud-based technologies using QR code and short-range wireless technologies such as Near-Field Communication for contactless payments (Zhang et al., 2023). QR code technology is now becoming the mediator for consumers to view a menu, place orders, and make a payment. Moreover, this change in post-COVID-19 payment behaviours is a result of social distancing and lockdown measures, which have contributed to the evolution of customers’ payment behaviour (Sahi et al., 2021).

According to a recent study, 83 per cent of respondents confirmed that they have used the QR code payment first the time during or after the pandemic. The findings indicate that QR code is the preferred payment option, with 84 per cent of UK citizens using QR code for a meal (Juniper, 2021). This new business model represents a shift in the behaviours of the consumers who visit a restaurant and mainly the result of increase in the reliance to adopt QR code payments. The findings from the Bank of England, show a surge in digital payments in mid-2016, when cards overtook cash as the preferred method of payment in the UK, and cash withdrawals continued to decline by 60 per cent compared to 2018. Moreover, studies (Web, 2020), have revealed that 67 per cent of small businesses and 78 per cent of consumers have adopted new payment behaviours to adjust themselves during the pandemic.

Many research models have investigated customer adoption behaviours in QR code payments. The findings suggests that there is still a lack of conceptual framework for understanding the increased adoption of post-COVID-19 QR code payment behaviours, and a dearth of knowledge from both the consumer and merchant perspective (Sahi et al., 2021, Mondego and Gide, 2018). One of the earlier reviews in mobile payment in the field of electronic payments between 2013 to 2020, by Mondego and Gide (2018) identified only four studies that have been conducted with a focus on merchants. A study by Li (2018) concluded that very few studies address the intentions from merchants to adopt QR code payment and identified a clear knowledge gap in this area. However, focusing only on the consumer experience with limited insight from the merchants perspective indicates that there is still an inadequate systemic understanding of this new form of payment adoption (Suo, 2019).

This study contributes to the literature by demonstrating the influential and behavioural factors in post-COVID-19 QR code payments. This study aims to develop a conceptual framework for the QR payment adoption by investigating the literature on post-COVID-19 QR code technology and map the relevant studies in the field. Reviewing the most recent literature during the post pandemic is the core scope for answering the target research questions to understand the current knowledge surrounding QR payment adoption in the food and beverage industry among consumer and merchant in restaurant services. To address the research questions the study therefore presents a review of the relevant studies published so far post 2019.

Covid 19 pandemic and the impact on the new digital payment trend increasing adoption of QR payment technology (QRP)

The pandemic has strengthened the digital economy towards the use and adoption of a new form of cashless society. The QR code technology was invented in 1994 and became a highly popular payment method in 2016 with a third of all Chinese payments made by QR code, reached a value of \$1.65 trillion (Tetnowski, 2022). In Western countries, QR payment had a slower adoption rate, but then its adoption escalated during 2020-2021 soon after the Covid-19 pandemic as a consequence of the pandemic. This change resulted to a new social dynamic (Liébana-Cabanillas et al., 2019). Figure 3 illustrates the impact of the pandemic.

A Systematic literature review on QR Code Payments Adoption in the Post-pandemic Era

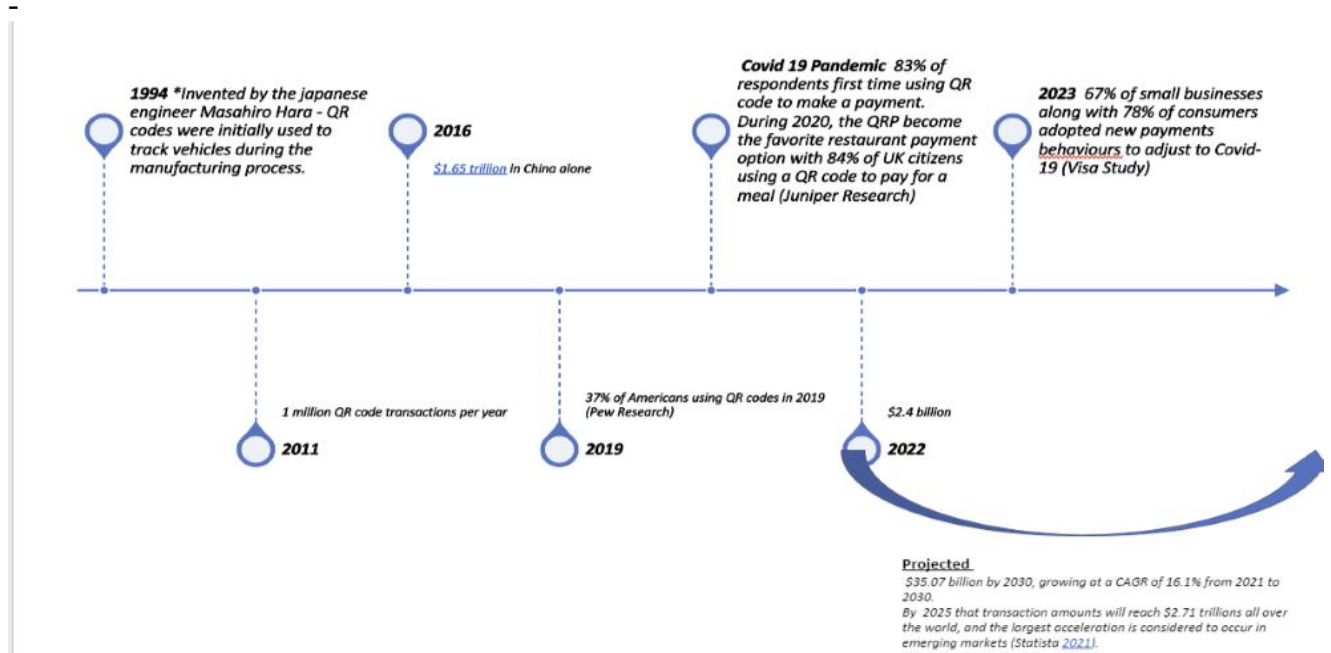


Figure 3. QR code payment evolution

Few studies have investigated the impact of Covid-19 on consumer and merchant behaviours in the food and beverage industry. Furthermore, there is limited research that has focused on the immediate effect of the outbreak on the rapid adoption of QR code payment technology and changes to the business model (Lu et al., 2022). The food and beverage industry, especially in restaurants, is one of the most disrupted services. However, there are limited studies currently available on this topic of post-COVID-19 QR code technology and only a few studies explored the increased adoption behaviours and influential factors of consumers and merchants on QR code technology during post-COVID-19.

The payment ecosystem is in a state of transformation and from consumers, and businesses to Financial Institutions they face internal and external different challenges such as technology adoption consequences, profitability, consumer satisfaction and increased market competition. In this situation is important to reevaluate the current infrastructure and the different payments' perceived challenges and benefits. For businesses is important to adapt, empathize with the consumer and be compliant with this new business financial environment.

For years, businesses could not create true empathy with their customers. By understanding the business side of QRP adoption and the state of knowledge of QRP loyalty data usage to create real consumer needs products not just based on instincts or speculative directions. Overall, understanding the increased adoption of Qr Code payments in restaurants can

provide valuable insights into the changing payment landscape and help businesses adapt and stay competitive.

2. METHODOLOGY

This study undertook a systematic literature review (SLR) methodology by reviewing the extant literature on QR code payment to evaluate the impact of post-COVID-19 QR code payments adoption behaviour in restaurants and challenges and benefits to consumers and merchants. The objective of this study is to explore the current state of research on post-COVID-19 QR code payments and mapping the current state of the empirical research and interpreting the patterns identified to develop recommendations for future research.

The overarching aim of this paper is to provide a comprehensive overview of the studies published in the QR code payment field after 2019, specifically post-COVID-19 QR code payments. The SLR addresses various stages based on the following research questions:

- 1) To identify the most influential authors on the topic and the most influential work.
- 2) To identify the patterns among authors and countries' specifics.
- 3) To identify the common theory and common constructs among reviewed papers.
- 4) To determine the topic literature progression and future research structure.

Based on the research questions, the inclusion and exclusion criteria were identified as shown in Figure 4.

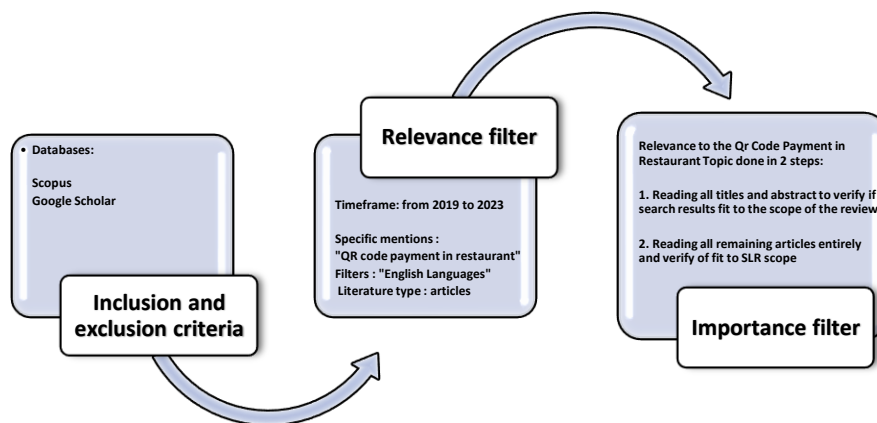


Figure 4. Inclusion and exclusion criteria

Exclusion criteria:

- i. By year – timeframe limited to 2019-2023.
- ii. Papers in languages other than English.

- iii. Papers that do not present studies related to QR code payment.
- iv. Papers the full text of which were not accessible from the databases, were excluded from the literature review.

This SLR has also answered recommendations from prior researchers to investigate the new trends in payments of post-COVID-19 QR code payments. The findings of the SLR further provides practical implications for the financial industry, payment ecosystem for retailers, particularly to understanding the significance of affecting QR payment adoption. Moreover, this paper provides data for the third-party providers for merchants to develop a new business model to integrate the acceptance of self-service digital payment technology.

2.1 Planning of the Systematic Review

This paper sets out to understand what aspects of QR code payment have been most studied by researchers. In doing so, this study categorised 75 studies through identifying the common patterns and divided them by the most relevant topic to answer the research questions. The full list of the articles surveyed can be found at [SLR.xlsx](#)

Instead of clustering the co-citations or patterns to illustrate the reviewed papers on post-COVID-19 QR code payments, the SLR conducted the flower plot and is intended to be seen as a map of research on QR payment used in the post-pandemic context. Figure 5, illustrates some of the reviewed studies with the main framework details, authors, year, location, citations, and key results.

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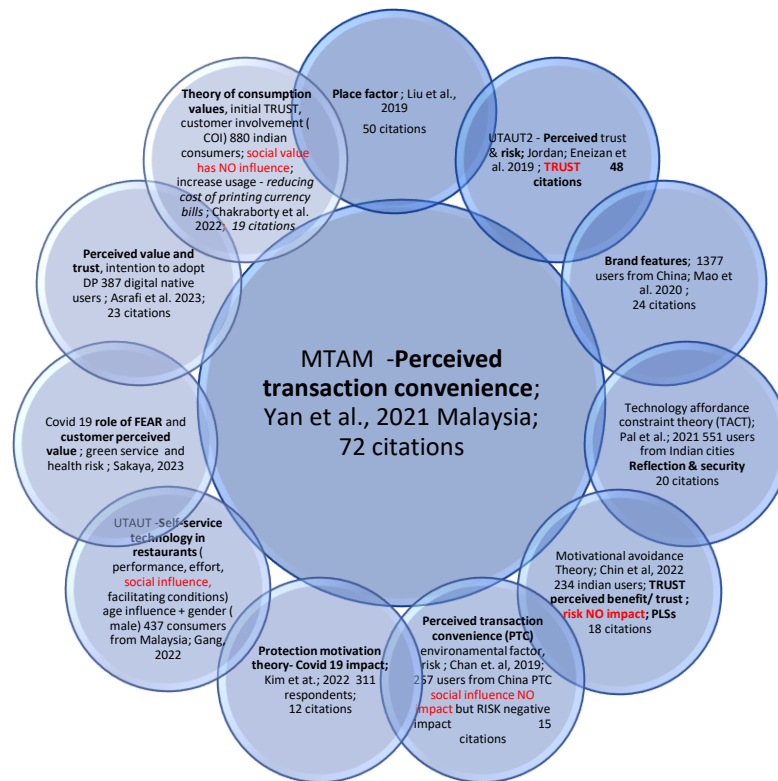


Figure 5- Association between QRP and adoption factors

We have identified the most cited authors that have contributed towards the literature on QR code payments Liebana-Cabanillas, based on the research topic in which Yan, Liu, Kim and Mao have emerged as the most influential authors who closely align RQ1.

Furthermore, during our review of the literature, there were inconsistencies found on the incorporated constructs in behavioural intentions to post-COVID-19 QR code payments. There is research (Eren, 2022, Eneizan et al., 2019) that have focused on the customer experience to the perceived transaction speed and optimism as behavioural factors and excluded construct of trust. The study results were also endorsed by Chen et al. (2019) who conducted a similar research study to identify the main acceptance drivers of mobile payments. Chin (2022) also found that trust as the main adoption factor. Moreover, Chin (2022) study had been performed on 234 Indian users, on the potential cultural factors which may exhibit differences.

Other studies described the social influences as the main adaptive mechanism (Chen et al., 2019) and (Chakraborty et al., 2022), challenging (Gang and Pyun, 2019) research finding from his survey on 427 consumers from Malaysia in which the social influence is the main facilitating condition showing that the age is the predominant adoption factor. Mostly the younger population and gender has been found as core facilitators among males being the

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predominant adopters (RQ2). Thus, we can conclude that answering the RQ1 and RQ2 mapped highly among the studies cited and provided pertinent insight with interesting differentiation in the outcomes of the studies. However, none of these studies mentions post-COVID-19 QR code payments in the food and beverage industry. This result reveals that there is a significant knowledge gap in the literature on QR code payment adoption. Thus, new consumer payment behaviour presents further scope for future research. As shown in Figure 6, there are few researchers that have addressed the improvement to the current literature on post-COVID-19 QR code payments.

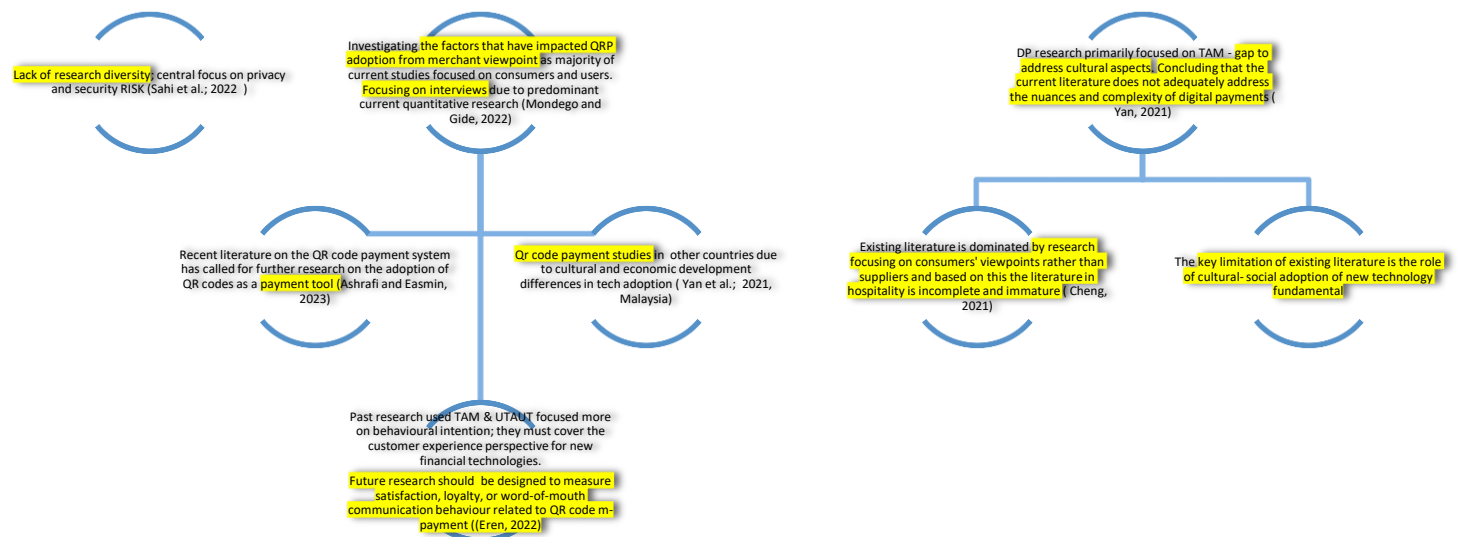


Figure 6- Future research opportunities

This systematic review has focused on papers on the topic to better understanding of the post-COVID-19 QR code payments. However, the review found studies that discuss QR code applying QR payments on technological or psychological factors rather than specifically on payment behaviours among consumers and merchants. Thus, the literature review reveals a literature gap in the field and promotes future research to investigate this unexplored research area.

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To provide a systematic, transparent and reproducible literature review of post-COVID-19 QR code payments, this study has been carried out by following the guidelines suggested by Davies and Crombie (1998). The step-by-step review process is illustrated in Figure 7.

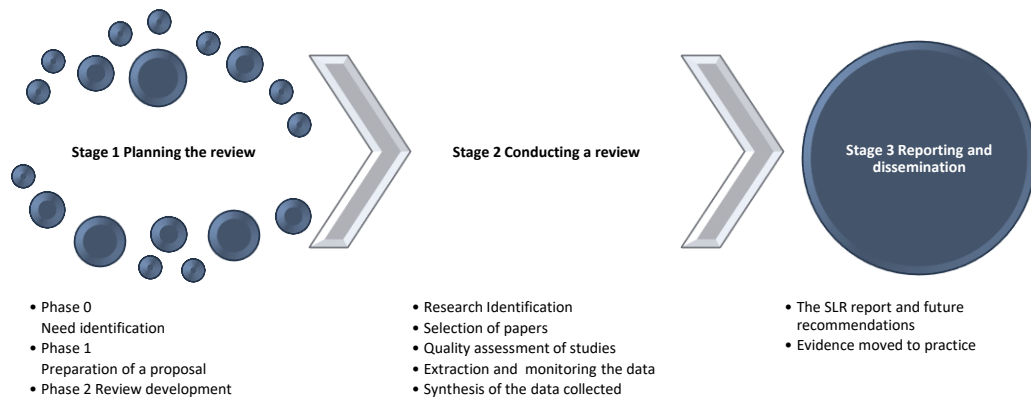


Figure 7. Stages and phases of Systematic review (Source: author interpretation of (Tranfield et al., 2003))

STAGE 1 Planning the review.

Following the process developed by Davies and Crombie (1998) in the first stage, the review protocol was based on above defined review questions aiming to address them via the process. The search strategy identified the relevant studies and the qualification criteria for inclusion and exclusion was based on an interpretation of key questions. Thus, the initial stage of the systematic literature review can be seen as a constant process of definition and clarification. A pre-scoping review was conducted in April 2022 to assess the volume and relevance of existing literature to the topic. For the stage 1 of the SLR, a full search has been conducted in Scopus Database using a combination of keywords with a series of trial searches to determine the selection of keywords as the exact search would have a significant impact on the literature databases output (Yan and Lu, 2018)

The first phase was the scoping of SLR during April to May 2022 and reviewing journals published between 2018 to 2022, and then combining the keyword digital payment and business ecosystem. The early pilot concluded with seven articles, all thoroughly reviewed, one published in 2018, in 2020, in 2021 and the other four more recently in 2022. The most cited paper had 101 citations and had been published in Technological Forecasting and Social Change Journal. REF The authors mainly focus on extending the technology acceptance model (TAM) to understand smartphone users' intention of adopting different mobile payments (SMS, NFC and QR codes). According to several authors, the QR payments has some

significant attributes that can explain its rapid adoption and perceived risk (Suebtimrat and Vonguai, 2021, Das et al., 2021); perceived security (Musyaffi et al., 2021), perceived value (Zhong and Moon, 2022), customer experience (Eren, 2022, Chohan et al., 2022).

Furthermore, in the same stage 1, phase zero another pre-review was conducted in June 2022 based on Scopus, by reviewing journals between 2018-2022 using digital payment and QR code as keywords for title, abstract and keyword database. 14 articles were qualified for full reading with inclusion criteria and keywords and four were published in 2019, one in 2020, seven in 2021 and five in 2022, using mainly quantitative methods.

In phase 2 of the review development was concluded forming the inputs and defining the research identification phase. Pal et al. (2021) authors had proposed that the focus for future research should be on different mobile payment from various merchant sectors and analysing the bill payment (Patil et al., 2017). These authors demanded further research on post-COVID-19 in matching mobile payment adoption. After these trial searches were conducted, there was an evident gap in the literature, as to what previous researchers contended with regard to the significance of increasing the knowledge of QR code payment ((Karniawati et al., 2021).

Currently, the literature does not clearly understand the capabilities and basis of QR code payment, and further in-depth considerations need to be given to QR code technology (Liébana-Cabanillas et al., 2019) and with better focusing on autonomous and dependent payment (Liu et al., 2021).

This is the first systematic review on QRP post-covid targeting studies to the Food and Beverage industry which analysed the existing knowledge and provides future research directions as suggested in previous studies (Sahi et al., 2021).

STAGE 2 Conducting a review.

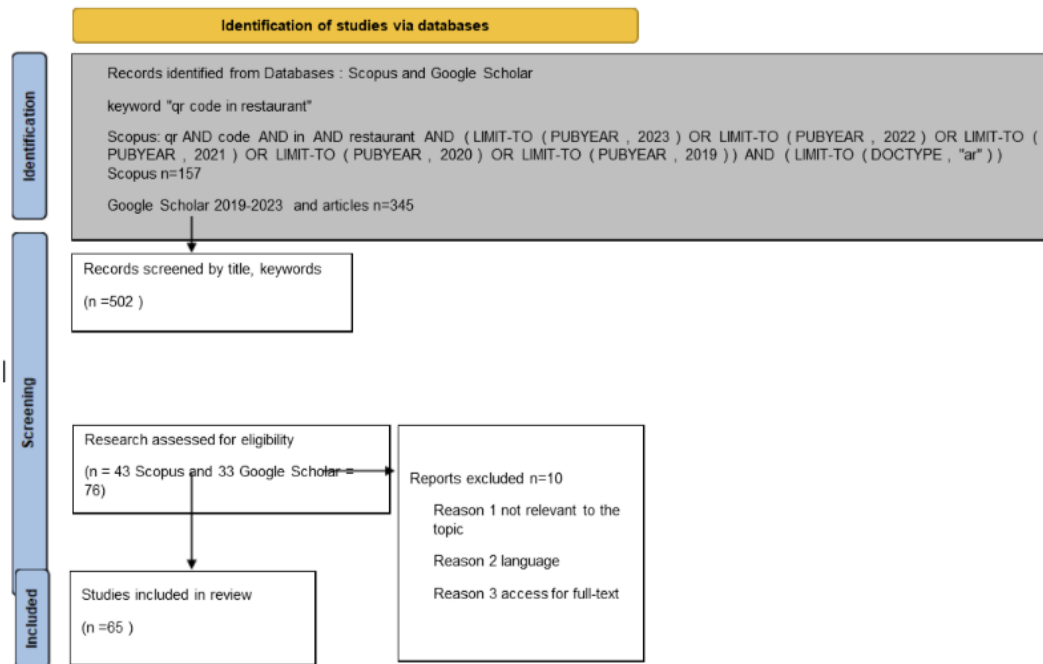
Furthermore, because of the gap in the literature on the increased adoption of post-pandemic QR payment in Food and Beverage industry, this study has conducted a critical review method to explore possible answers. In the next stage, the keyword used was QR code in restaurants and targeting literature available in Scopus and Google Scholar database during the period 2019-2023.

The initial search has been conducted in the Scopus database which is known for its in-depth coverage of peer-reviewed articles with high-quality content. The Scopus search was supplemented by searching in Google Scholar, which offers a wide range of journal articles comparing to initial search. Through this process, 156 articles have been retrieved. We then compiled the articles from both the database and found articles without full-text access. After subtracting the duplicates and no-full-text-access articles, we were left with a total of 76 articles.

The extracted data was imported in the form of .csv and stored for later analysis. In addition, a stored copy of the list was saved in Scopus list folder and Google Scholar library. A full and complete list with the trial stages [SCOPUSF \(2\).xlsx](#) . Moreover, notifications have been activated for any further published papers matching the previous searched on both Databases.

After full reviewing of the n=76 papers, a summary had been constructed to perform the data analysis. Following Davies and Crombie (1998) theory the data extraction forms (phase six) included title, authors, journals, publication details, theories, brief rationale. To clearly show the complex SLR stages the Figure 8 present the PRISMA (Moher et al., 2010) diagram which summarises the analysis in a more simple format.

Figure 8. Prisma View of the SLR process.



From n= 76 eligible articles selected was screened for quality by closely reading through the full text of each article thoroughly based on the topic relevance. The study applied full text reading and keywording strategy to devise our classification scheme and categories for the reviewed papers. Furthermore, at first the abstracts have been fully read to match the concepts and reflect the studies contribution. As a result, ten articles were screened out and 65 articles were selected for the final review.

Stage 3- Reporting and analysis

This section presents the findings of the systematic literature review providing a comprehensive assessment of the various theories, models, and constructs. At the third phase,

following the Systematic review process, we provide a detailed audit with justification and conclusions (Tranfield et al., 2003), auditing the cross patterns results of the last stage in Scopus and Google Scholar literature review with answers further linked with the study research questions RQs (the most influential author and research studies).

In analysing Figure 6, we can identify the primary studies classified by date of the publication as shown in the literature topic progression. First, we reviewed n=7 journals published in 2019, and a small increase in 2020 n=8, and n= 15 in 2021 and in 2022 with n=32 and in 2023 n=3. Prior to 2019 several studies were published, however for this study we selected the most recent scientific journals for accurate interpretation of post-COVID-19 QR code payments (after 2019) to better understand how the new payment system was impacted by pandemic. However, most of the studies were not related to adoption behaviours in restaurants and this result reveals that QR payments is a new research trend and deserves greater focus from the perspective of the consumer and merchants' which answers RQ4.

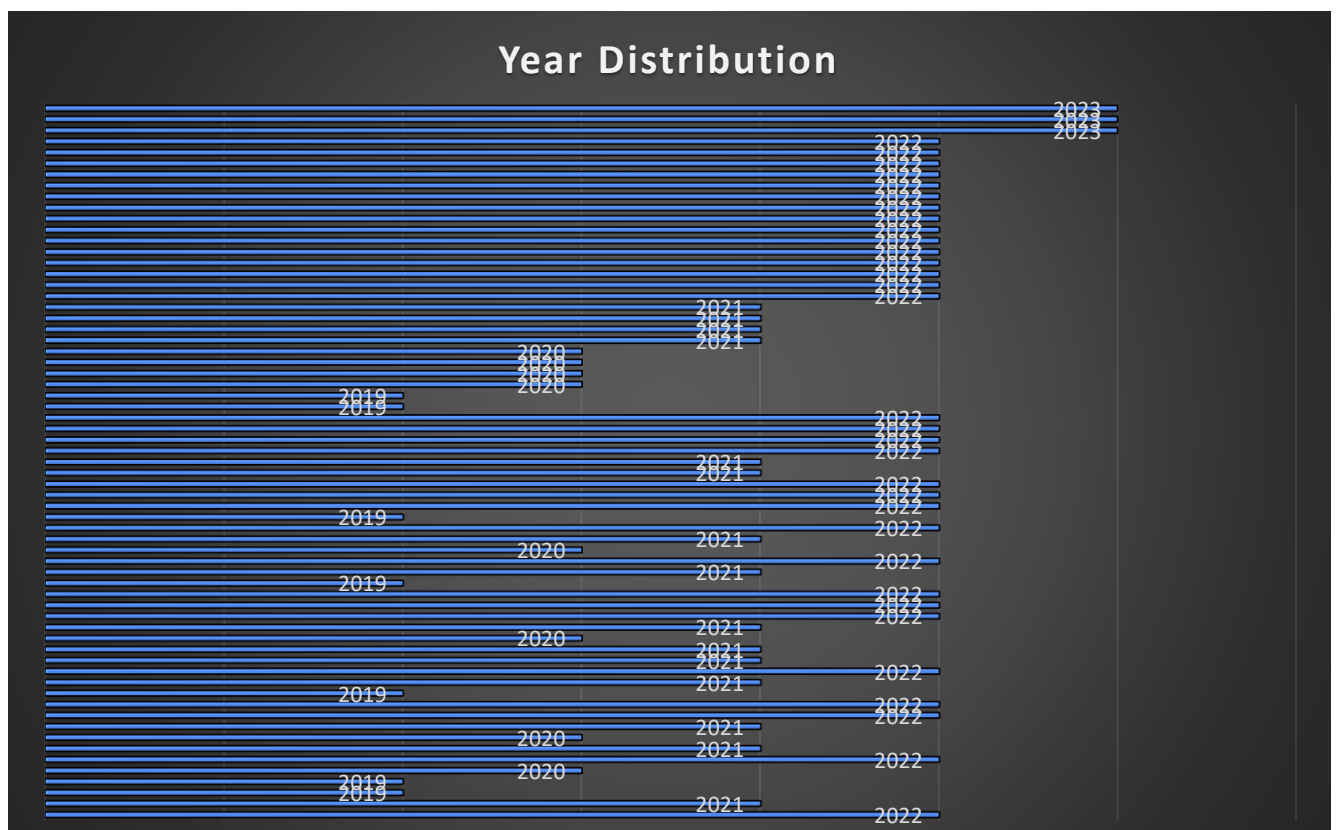


Figure 6. Overview of the distribution of the reviewed studies throughout the years

The citation analysis was used as a significant technique to conduct the SLR. The citation analysis determines the popularity of a selective publication in the body of the existing

literature based on the citation number (Sahi et al., 2022) and answers RQ1. Analysis from the most prolific authors provide key insight about the contribution and influence in the field. The most notable publication is (Yan et al., 2021) with 72 citations published in 2022. The authors analysed the impact of mobile payment adoption intention, in particular the Quick Response (QR) code technology, through an extended Mobile Technology Acceptance Model (MTAM) and recognising the weaknesses of the TAM theory. The research also focused on the perceived transaction convenience and speed as the main tested valence of behavioural intention. The study recommended further focus on the acceptance of different mobile payments due to lack of literature (Yan et al., 2021). The next highly cited study is by Liu et al. (2021) and their work examined the locational factor to consumer behavioural characteristics.

The overall thematic research on the specific topic trends can be demonstrated through using the citation analysis and therefore, the answer for RQ4 is a lack of approaches that combine post-COVID-19 QR code payments and post-pandemic acceptance. Highly cited journals had been supporting the theoretical frameworks and methodological maturity in the literature.

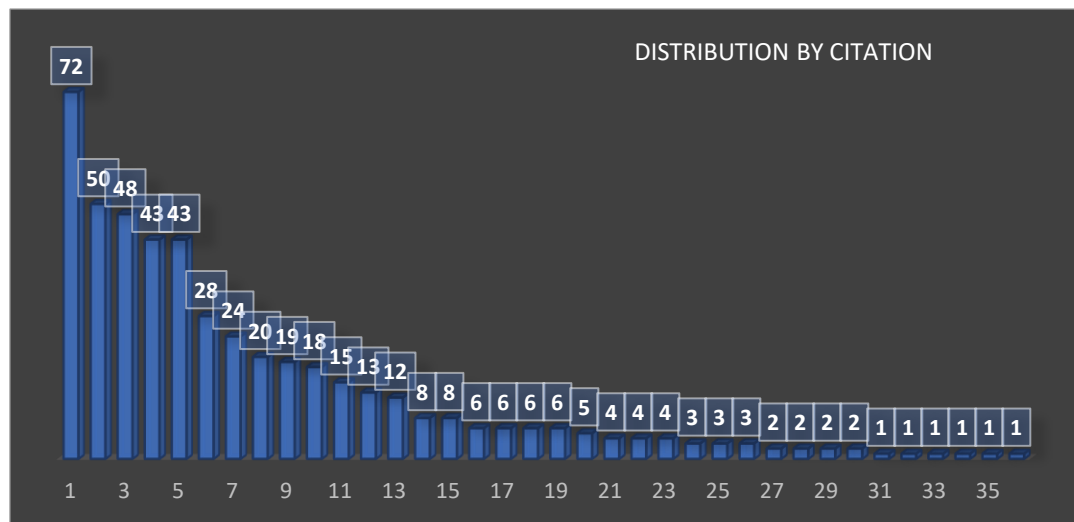


Figure 7- Distribution by citation.

Furthermore, by analysing the distribution of the studies based on the research patterns identified, we found a key valence category that has already been explored. The one that draws the most attention (Yan et al., 2021) on transaction convenience is speed, perceived trust, risk, pleasure, and digital payments acceptance. The patterns as shown in Table 4 answers question 4 of this research. Despite the reviews published thus far, the literature on QR payment and the extent of adoption behaviours accelerated by the pandemic has not been sufficiently researched.

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The results of the literature review supports prior research of (Harris et al., 2019) that MTAM and TAM models have dominated the theories that describe how users come to accept and use a technology. TAM has been focused on the positive aspects of a consumers perspective including the emotional, external, or environmental factors on the adoption of new technology (Sahi et al., 2021) and (Yan et al., 2021).

Consumer Behaviour	Perceived Risk	Perceived Trust	Satisfaction/ Pleasure	Technology Acceptance	Perceived Value	Privacy	Safety/security	Convenience/ efficacy/ Innovativeness
(Liu et al., 2021);(Eren, 2022); (Yan et al., 2021)	(Eneizan et al., 2019, Chin et al., 2022); (Sahi et al., 2021); (Harris et al., 2019); (Li et al., 2020); (Das et al., 2021)	(Eneizan et al., 2019, Chakraborty et al., 2022, Chin et al., 2022) (Musyaffi et al., 2021);(Chohan et al., 2022);(Harris et al., 2019); (Li et al., 2020); (Das et al., 2021);	(Liu et al., 2021); (Ferràs et al., 2020); (Chohan et al., 2022); (Hossain et al., 2019); (Sahi et al., 2021); (Zhong and Moon, 2022);	(Yan et al., 2021);(Prodanova et al., 2021);(Sciarelli et al., 2022); (Hwang et al., 2020); (Sciarelli et al., 2022); (Iskender et al., 2022a);	(Blasimme et al., 2021); (Chen et al., 2019); (Zhong and Moon, 2022);(Sakaya, 2023)	(Sahi et al., 2022)	(Kim and Im, 2022);(Musyaffi et al., 2021) ; (Abdou and Shehata, 2021); (Sahi et al., 2021);(Almuhammadi, 2020)	(Hwang et al., 2020); (Chen et al., 2019);(Yasami et al., 2022); (Zhu and Wang, 2022) (Yan et al., 2021)

Table 4. Primary studies on QR Code Payments categorized by research construct.

In analysing the table, we can identify that the most investigated research objective is the perceived trust being the main factor in 8 studies. As for other studies, they described of consumer behaviours (Liu et al., 2021, Eren, 2022, Yan et al., 2021), satisfaction (Liu et al., 2021); (Ferràs et al., 2020); (Chohan et al., 2022); (Hossain et al., 2019); (Sahi et al., 2021); (Zhong and Moon, 2022); safety and security (Liu et al., 2021); (Ferràs et al., 2020); (Chohan et al., 2022); (Hossain et al., 2019); (Sahi et al., 2021); (Zhong and Moon, 2022); convenience (Hwang et al., 2020); (Chen et al., 2019);(Yasami et al., 2022); (Zhu and Wang, 2022) .

Despite the growing number of studies on digital payments, there is a scarcity of research on convenience perception of QR code payment. The findings indicates a lack of focus on post-pandemic impact and shows that it is necessary for more research to be done on merchants perspective, to report on their post Covid experience (Iskender et al., 2022b). Future research can focus on the business impact, the business benefits, strength, and challenges to QR payment adoption. To better understand the impact of the pandemic on payment adoption, further studies should use different factors comparing with previous researched to enlarge the spectrum of knowledge. This can be formulated with mainly perceived transaction convenience, valence framework and customer experience, loyalty, profitability, business usefulness and transaction speed antecedents, as seen in Figure 8 on the author's proposed future framework. This path of

investigating the QR payment may provide in-depth insight from a merchant perspective as well as the consumer perspective.

Contrary to the predominant topic literature which focused on quantitative studies from consumers perspectives and mainly using the TAM or M-TAM theories, the adoption of QR code payments in restaurants can be further examined using a qualitative approach rooted in diffusion theory and targeting merchants. Diffusion theory considered adoption of innovations as social process shaped by a range of factors, including social influence, communication channels and individual characteristics behaviours. This approach may reveal unexpected challenges or facilitators to QRP adoption and can provide in-depth insights into how restaurants owners/ managers can successful integrate QRP into their businesses. This can have a positive development form utilitarian perspective, reducing time, reducing human errors in ordering or potential friction in the transaction process.

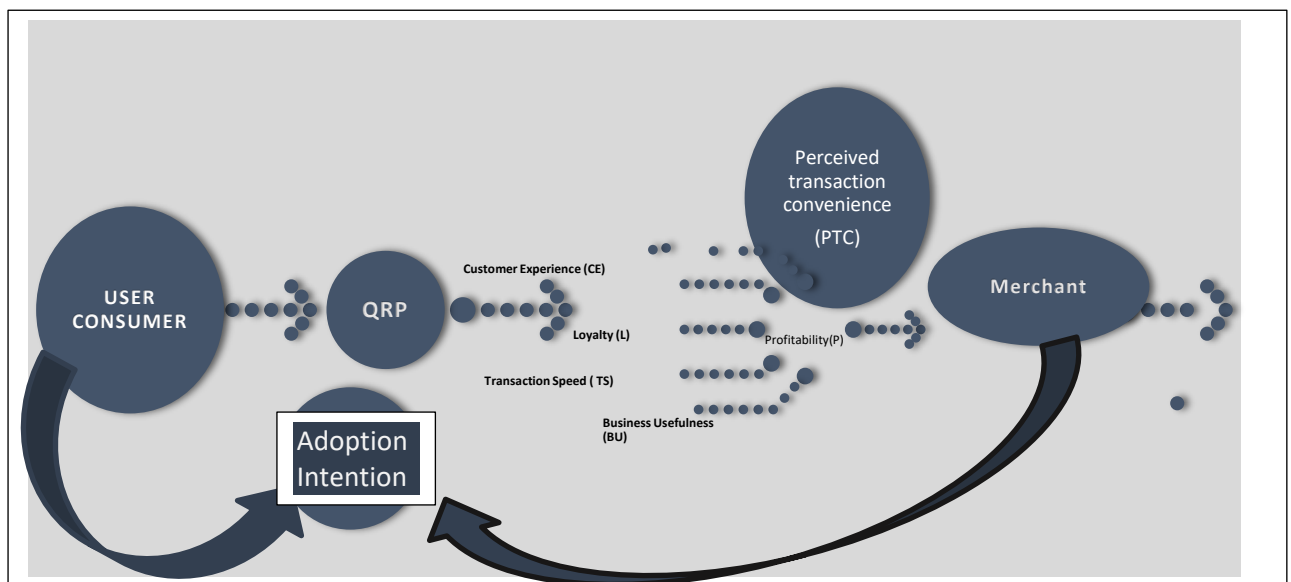


Figure 8. Proposed QRP framework for future studies.

CONCLUSION

The primary purpose of the mapping review is to provide an overview of the most recent studies in the field of QR payments. The study followed a systematic methodology with defined research questions to fulfil this goal. This paper provided a scoping review of the literature on post-COVID-19 QR code payment technology. The study reveals the most influential authors and studies (RQ1) and the valences investigated (RQ2) by previous researchers from 2019-2023. The purpose of this paper is to focus on studies that the post-pandemic journals and

factors impacting the on this topic of post-COVID-19 QR code technology adoption in restaurants.

The answer to RQ4 based on the results, it was identified that most studies were conducted using quantitative research using questionnaires and surveys as the main instrument. These studies were mainly concerned with consumer perspective as the main research focus. However, few studies have gathered an in-depth perspective from participants', and few studies consider a systemic understanding of both the consumer and merchants' perspectives on post-COVID-19 QR code adoption behaviours. This study identified a lack of combined valence approaches, and most studies have focused on trust-related behaviours (RQ4). Moreover, this paper presents gaps and future research opportunities in assessing the literature on QR payment thereby determining future research opportunities.

There is limited research on this topic and can be expanded with further focus on other industries impacted by the pandemic or the different types of cashless payments with consideration on investigating both the merchant and consumer perspectives, and the challenges to the business, as well as the benefits of the QRP adoption.

Furthermore, merchants should focus on the new business model, understand, and adapt to new technologies to stay competitive, keeping appropriate systems by offering a good customer experience and convenient process. Moreover, further studies on the financial implications of the QR code payment adoption to better understand how technology can resolves human resources and the pressure on restaurants on QR Payment adoption.

This is the first comprehensive review to collect and classify the emerging QR payment by unveiling the associated challenges on post-COVID-19 QR code technology adoption behaviours. It provides theoretical and practical directions in the field. The systematic literature review offers new insight for future researchers in the field of digital payments by complementing previous studies and highlighting the most influential research on QR payment. Most importantly this paper provides opportunities to further explore digital payment ecosystems in order to overcome the challenges to post Covid-19 technology adoption.

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