

EXPLORING LITERATURE ON THE ACCEPTANCE AND APPLICATIONS OF QR CODES FROM MARKETING AND CONSUMERS PERSPECTIVE: A SYSTEMATIC ANALYSIS

Ewa JERZYK

Poznań University of Economics and Business; ewa.jerzyk@ue.poznan.pl, ORCID: 0000-0001-8474-3570

Purpose: In recent years, two-dimensional bar codes, most commonly found in the form of QR (Quick Response) codes, have become widespread. They are used to encode various information that can be read by smartphones, tablets and other electronic devices. The codes can convey information, at the same time triggering certain consumer reactions and behaviours. Despite the increasing use at the time of the pandemic, successful applications in promotional campaigns and a number of benefits for broadening the awareness of products labelled with them, the number of studies on QR codes is unsatisfactory. Adopting a micro-perspective of the consumer and marketing, a review of studies that address QR codes was conducted. The aim of the paper is to present publications and evaluate the current state of research relating to the acceptance and use of QR codes from the perspective of the consumer and marketing, and to identify future recommended lines of research.

Design/methodology/approach: In this study, a systematic review of studies based on two academic publication databases (WoS and Scopus).

Findings: Four main strands of research on QR codes from the consumers perspective were demonstrated: the acceptance of the new communication technology, the impact of the codes on the purchase decision process, their usefulness from the perspective of specific consumer needs, and the appearance and design of the codes. It can be expected that future research will focus on more specific issues, such as the acceptance of QR code technology in specific categories of products and services, including public services, representing a higher level of social trust, which is important in consumer optics. What is important in consumer behaviour are values, including environmental ones (buying environmentally friendly products, willingness to make sacrifices to protect the environment, and awareness of the consequences of consuming unsustainable products). They have so far been neglected in research and are an increasingly important motivation for consumers' information-seeking behaviours through QR scanning.

Originality/value: The findings gathered by the researchers on consumer behaviour toward QR codes can be useful in planning marketing and promotional strategies aimed at sustainable development and responsible consumption. They also serve theoretical and methodological development.

Keywords: QR code, consumer, marketing, marketing communication, systematic review.

Category of the paper: Literature review.

1. Introduction

The expanding scale of mobile device use has brought about significant changes in the ways people communicate, shop and access services. In 2022, more than 60% of Internet users will use mobile devices to surf the Web (Global Mobile Traffic Share by Region 2024, n.d.). While being inside a shop, four in 10 consumers use their phones in order to get access to product information and comparisons online. More than a third (36%) use them while standing in front of a product to compare the price in a shop or on a competing retailer's website (PricewaterhouseCoopers, n.d.). The growing use of mobile devices by consumers makes it justifiable to take a closer look at one form of connectivity between the physical and virtual worlds, namely QR (Quick Response) codes. These codes are one of the most promising technologies for increasing the possibility of influencing the consumer (Rotsios et al., 2022). Invented by Denso Wave in Japan in 1994, originally to track car parts, they began to be used in the pandemic as primarily a form of contactless payment, a vaccination passport, or to facilitate access to information. Today, the codes are a subject of interest due to developments in IoT technology, product identification (including a digital product passport), and concerns regarding the quality of goods. Marketing communication is also an important application area for QR codes (Hossain et al., 2018).

The digital product passport as introduced under the Green Deal in the European Union (Dyrektywa Parlamentu Europejskiego i Rady 2009/125/WE) is a collection of product data specific to a product category, such as the name and location of the manufacturer, how and where it was produced, composition, values, safety rules, but also other information that is desired or can be expected by the consumer (or other participants in the supply chain). The digital passport does not replace the information on the label and packaging but extends it and makes it easier to understand. It can provide up-to-date information about the quality of the product, which changes with time, and storage conditions. Finally, it can strengthen the consumer's experience derived from the relationship with the product. Its carriers are bar codes, QR codes, RFID (radio-frequency identification) or other digital solutions brought about by the development of modern technology. Due to its capacity and easy availability, it is QR code that is the recommended method of labelling by certification bodies such as GS1. The utility of QR codes is tailored to the needs of the supply chain participant (manufacturer, middleman, trade, consumer).

QR codes are a response to consumers' growing need for information about products introduced into the commodity market and their influence on health and life. Genetically modified grains flooding the Polish market during the war in Ukraine, pesticide or plastic content in food, bacterial contamination, defective product quality or counterfeit goods are just a few examples of current consumer concerns that can be mitigated by access to the information offered by the code. QR code labels bring greater transparency to supply channels. Moreover, their widespread adoption is expected to translate into more sustainable consumer behaviour and greater concern for environmental protection. A consumer motivated by environmental values can access detailed information about the path a product has taken and its carbon footprint. Therefore, codes mean access to product information that enhances consumers' position in relation to the retail company or manufacturer and supports them in more informed purchasing decisions.

On the other hand, QR codes are a new channel of brand-consumer communication connecting the offline and online worlds, called mobile communication (Vatanparast Butt, 2009). Unlike the traditional form of marketing communication, mobile devices offer personalized and interactive communication and make it easier for consumers to access marketing messages anywhere and anytime (Ryu, Murdock, 2013). Among the various mobile communication technologies, we distinguish between two forms: push and pull (on-demand). QR codes are assuming an increasingly important place in mobile advertising, since they are considered non-invasive and non-intrusive forms of messages (Narang et al., 2012). Jung et al. (Jung et al., 2012) define QR codes as innovative marketing tools to support companies in advertising products, services and private brands. A number of advertising experts expect QR codes to increase return on investment and boost consumers' interaction with the brand. Research findings indicate (Role of QR codes in advertising 2022, n.d.) that advertising campaigns aimed at Generation Z in particular should use QR codes. In addition, codes are categorized as effective forms of improving DOO (Digital Out-Of-Home) interactivity.

The use of codes increased during the pandemic, which prompted a shift in contactless payments via mobile apps, and QR codes became more popular as customers were able to pay for goods and services without having to physically carry cash or cards. Hamzah (2023) gives the example of Malaysia, where in the pre-pandemic period, interest in cashless transactions remained significantly low among both consumers and sellers. The pressure to remain cautious and detached created an opportunity for a rapid transition away from cash and card payments to contactless payments (after the pandemic, cash payments in that country accounted for 34% of all transactions).

The current state of knowledge on the use of the codes by end users is limited. We know that QRs are used in the home rather than in commercial settings (Ozkaya et al., 2015), more often by practical and highly committed users (Meydanoğlu et al., 2015), and the scale of their application varies from country to country. Users tend to be younger people, referred to as mavens, although research does not always confirm this. This systematic review is one of the first to analyse research on the use of QR codes from the perspective of consumers and marketing. The method adopted for the review is to identify the main directions of ongoing research on QR codes, to identify the penetrated areas of the consumer's relationship with this new communication channel, as well as those unexplored. The following objectives were set before the development of the review:

- to compare and evaluate the methodology of the research carried out to date in relation to the aim of the research and the theoretical framework adopted,
- to identify the research conducted in terms of the object/subject of the research, sample size, methods of analysis adopted,
- to compile the main empirical findings of the research,
- to identify the lines of future research.

An overview of the research can help scholars prepare research methodologies on the ground of the studies completed so far and to facilitate the selection of the scope of possible future research. By indicating synthetic research implications, it can provide a basis for building marketing strategies that shape and consolidate sustainable consumer behaviour.

2. Methodology of the systematic review

To achieve the aims of this paper, a systematic literature review was used. According to Kitchenham and Charters (2007), a systematic literature review is carried out in three stages: formulating the research questions, carrying out the analysis (including establishing the criteria by which the literature will be collected), and reporting. In this study, literature was reviewed from academic databases: Web of Science (WoS) and Scopus. Initial searches in these databases, for QR code/QR codes “all fields” entries, showed that interest in the subject was increasing (Figure 1).

Using OR/AND operators, we conducted several rounds of screening. The search string was (“QR code” or “QR codes”) and (“consumer” or “consumers”) and (“marketing”). Finally, we applied limiting criteria to the categories generally attributed to the disciplines of management and quality and economics and finance (in the field of social sciences); in the case of WoS, these were business, economics, management, and in Scopus: business, management and accounting. The preliminary search returned 37 publications, of which there were 10 in WoS and 27 in Scopus. After rejecting duplicates, we obtained 29 publications, while impaired

accessibility to seven of them caused them to be omitted from further analysis. After a detailed qualitative review of 22 papers, it turned out that four of them were not empirical and used only references to other sources. The final review was based on 18 articles (Table 1).

3. Evaluation of the collected material

A review of the publications in the WoS database and Scopus in which the keyword “QR code” appeared reveals that the first publications date back to 1990, while the largest number were published in 2023 (Figure 1). The vast majority (97%) were written in English and positioned in the area of engineering, computer science, engineering, telecommunication. The share of publications falling into the categories of management, business and economics/business, management and accounting was about 3% in WoS and 6% in Scopus, respectively.

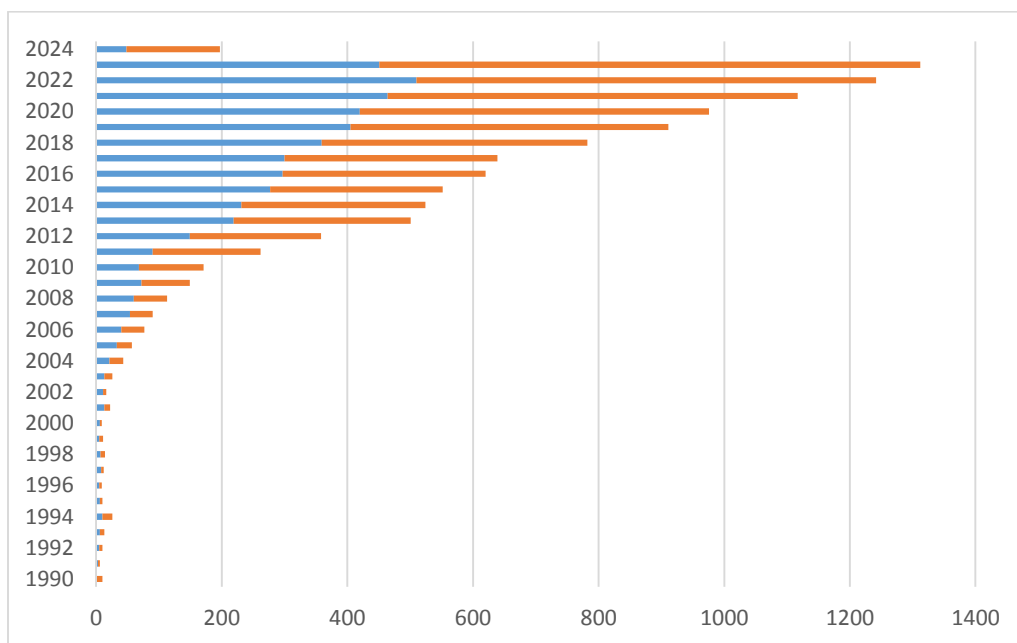


Figure 1. Number of publications in WoS and Scopus databases containing "QR code/QR codes" (all fields, not excluded, until March 2024).

Source: Own compilation based on WoS and Scopus.

An analysis of the results with respect to authors and publishing or funding institutions did not lead to any significant conclusions. The authors were unlikely to continue their studies, or at least they had not yet been published, no specific publisher was evidently interested in the topic, moreover, it was usually a state authority that funded the research.

The research issues focused on four main strands:

- the adoption of innovative communication technology, with a clear emphasis on mobile payments using QR codes (Eren, 2024; Hamzah, 2023; Le, 2022; Osman et al., 2021; Suo et al., 2022);
- the influence of QR codes on consumers' purchase decision process (Chen, Fu, 2015; Meydanoğlu et al., 2015; Trivedi et al., 2020);
- seeking information by specific groups of consumers, including those marked by a certain level of trust (Atkinson, 2013; Bashir, 2022; Ertekin, Pelton, 2015; Lombardi et al., 2017; Ozkaya et al., 2015; Tanner et al., 2019a);
- code features, aesthetics, appearance, brand fit, usability (Hossain et al., 2018; Okazaki et al., 2019a).

In their research projects, authors were most willing to use established theoretical models such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the Modified Unified Theory of Acceptance and Use of Technology (UTAUT2), the Theory of Planned Behaviour (TPB), the Consumer Decision Making Model and the Protection Motivation Theory. Researchers were quite unanimous in pointing to utility, usefulness and enjoyment as factors contributing to the acceptance of QR codes (Bashir, 2022; Osman et al., 2021; Suo et al., 2022). Interestingly, it was emphasized that respondents tended to follow their social group, people important to them (social influence), and that there was a kind of social pressure to behave in a certain way, in this case to use QR codes (Le, 2022; Lombardi et al., 2017; Osman et al., 2021; Suo et al., 2022).

Access to information hidden in a QR code modifies the flow of the purchasing process, especially in its initial stages (Chen, Fu, 2015; Okazaki et al., 2019b; Trivedi et al., 2020), when the consumer is actively seeking product information and is curious about it. Tanner et al. (2019a) emphasize the role of the quality of the information provided. The package of information provided in a QR code is part of omnichannel communication and should be integrated with other marketing messages (Chen, Fu, 2015). If the information is a repetition of that available on the packaging, leaflet or other form of communication, it will be worthless and negatively affect the consumer's experience (Eren, 2024; Lombardi et al., 2017; Sang Ryu, Murdock, 2013). Consumers' trust in the sender is linked to the quality of information available in the QR code - it is higher in the case of government institutions than corporations (Atkinson, 2013). In turn, opinions gathered in focus interviews carried out by Ertekin & Pelton (Ertekin, Pelton, 2015) point to the need to control the information contained in the codes to enhance credibility.

Looking at the results of the review, one should emphasize researchers' interest in identifying segments of consumers who accept and use QR codes. In general, it can be said that researchers agree with the statement that this communication channel is dedicated to a specific group - fairly engaged consumers (Trivedi et al., 2020), causal (Hamzah, 2023; Le, 2022), innovators (Tanner et al., 2019a), motivated by environmental values (Atkinson, 2013; Bashir, 2022) and utilitarian information (Ozkaya et al., 2015), but also by the desire for benefits such as a discount coupon or reward (Meydanoğlu et al., 2015; Trivedi et al., 2020). While the pandemic period influenced the stigmatization of those inclined to use QR codes as those manifesting fear of COVID-19 infection (Hamzah, 2023; Le, 2022), after that time this trait was more likely attributed to a situation of uncertainty when acquiring new, unfamiliar or craft products (Tanner et al., 2019b). Researchers stress that the motivation to use a QR is created by the context of the situation - the appearance and design of the code (Bashir, 2022). The usability of the code and the value of the information conveyed from consumers' perspective motivates them to scan the code, but one cannot underestimate the aesthetic value of the code, which draws attention and encourages a "scan me" action.

Questionnaire surveys dominated the arsenal of research methods used, and there were also experiments and qualitative research (individual and group in-depth interviews). None of the works analyzed used neuromarketing methods, which could be valuable from the perspective of examining the visual attention of codes (eye-tracking) or studies classified as neurometric, such as functional magnetic resonance imaging, positron emission tomography, near-infrared spectroscopy or electroencephalography.

An analysis of the content of the articles led to a few conclusions: the subject of QR codes does not have a satisfactory empirical representation, the available articles, for the most part, residually present the issue of QR codes in the field of marketing, and the authors use only a limited armory of research methods, limited to minor extensions of existing work. It is evident that the topic of QR codes is at an early stage of development, clearly subject to the influence of pandemic habits related to fear of contagion (contactless m-payments, contactless checking of product information in the store) (Eren, 2024; Hamzah, 2023; Suo et al., 2022).

Table 1.*Summary of the research review (n = 18)*

Source	Research aim/model	Method/sample size	Method of analysis	Findings
(Eren, 2024)	Consumer experience with mobile payments via QR code. Research output model: ISSM (Information System Success Model), in which the following were considered: the quality of the system, the quality of the information and the quality of the service.	Questionnaire method, 207 respondents who have had experience with mobile payments via smartphone and QR code (Turkey). Sampling: convenience sampling, purposeful selection, snowballing.	Modelling of structural equations by the partial least squares method (PLS-SEM).	The quality of information and the quality of the system associated with the QR m-payment code positively affect the QR customer experience. The quality of service does not affect the consumer experience. There is no correlation between perceived risk associated with QR code m-payment and the customer experience. The optimistic outlook of users when looking at technology positively affects the QR experience. The positive customer experience associated with QR code m-payment has a favourable impact on the intention to use it in the future.
(Hamzah, 2023)	The acceptance of mobile payments in contactless transactions among retailers in the wake of fear of contamination during cash transactions. The Protection Motivation Theory (PMT) model proposed by Rogers was used (Rogers, 1975).	Questionnaire survey, 448 respondents - small merchants (owner or manager) offering QR code-based mobile payments for one year (Malaysia).	Modelling of structural equations by the partial least squares method (PLS-SEM).	The users are worried about the damage and burden caused by the Covid-19 infection, which makes them intend to continue using mobile payment services. Yet the risk of infection has a limited impact on the continued use of QR payments (the knowledge of infection and safeguards against it increases over time). The merchants are less favourably inclined to use mobile payments when they are more costly and time-consuming than credit and debit card payments. A sense of self-agency influences the willingness to continue with mobile payments. The intention to carry on with mobile payments is stronger for older, but the perceived usability and trust for younger people.
(Suo et al., 2022)	Consumer adoption of QR code mobile payments, UTAUT2 model.	Paper questionnaires distributed in shopping malls, 453 respondents (Malaysia).	Modelling of structural equations SEM -AMOS.	The expected length of effort, facilitating conditions and hedonic motivation are statistically insignificant. Personal innovation, expected performance, social impact, habit and price value are important.

Cont. table 1.

(Bashir, 2022)	Consumers' intention to use QR in order to obtain sustainability-related product information. Technology Acceptance Model (TAM).	Online survey and field experiment with two types of codes (four supermarkets in Oslo, three brands of everyday consumer products, 3,720 codes, actual consumer behaviour), 250 respondents (Norway).	Simple statistical analysis, means, significance tests.	The perceived ease of use and perceived usefulness of QR codes are important predictors of consumer attitudes and intentions to scan QR codes. The visual elements of the codes: the QR code in green with an environmental cue, the call to scan, and the location of the code on the front of the package affect the intention to scan. QR codes with an evocative appearance were scanned at a higher frequency than QR codes. In total, the conversion rate was 4.22% (157 people scanned the code). Scanning might have been influenced by the brand image: the eco-friendlier it has, the greater the consumer's willingness to establish a relationship with this brand.
(Osman et al., 2021)	What factors influence the willingness of millennial tourists to use an e-wallet. Technology Acceptance TAM model (Davis, 1985).	Questionnaire survey, 100 respondents (tourists from Kuala Lumpur, Malaysia).	Simple statistical analysis with the use of SPSS.	Perceived usefulness, ease of use and social influence have an impact on the use of an e-wallet. Security issues were not important to surveyed millennials.
(Le, 2022)	Acceptance of mobile payments using QR, based on UTAUT and PMT (Protection Motivation Theory: perceived health risks related to COVID-19 infection, self-efficacy).	Online survey, 411 respondents (78.8% of the sample were under the age of 30) who have had experience of using QR code mobile payments in supermarkets and shops or intend to use this method in the near future; convenience sampling method (Hanoi, Vietnam).	Modelling of structural equations (CB-SEM).	Behavioural intentions to use QR mobile payments are motivated by key factors arising from PMT fear motivation (perceived severity, perceived susceptibility and a sense of self-efficacy) and important UTAUT factors (including expected outcomes, expected effort time and social impact) and the physical distance norm.

Cont. table 1.

<p>(Trivedi et al., 2020)</p>	<p>The influence of QR codes on the consumer decision-making process, used in ads for products with informational and emotional appeals and with different levels of engagement. Lavidge and Steiner's (1961) hierarchy of effects model, product involvement, informational and emotional appeals in ads.</p>	<p>Secondary data from the Ad Impact Monitor questionnaire survey of print ads with and without QR codes, from 26 high- and low-involvement product categories (Germany). Quota selection by gender, age and place of residence. Questionnaire method.</p>	<p>Multivariate regression model.</p>	<p>The effectiveness of QR codes is greater in the initial stages of the purchasing process in the case of products with a high level of engagement (to encourage information search). The codes are not effective for ads for low-involvement products, with informational messages. Ads for low-involvement products should include messages with emotional appeal (e.g., discounts, coupons, points in a loyalty program). QR codes with emotional appeals with low engagement can stimulate impulsive purchases.</p>
<p>(Okazaki et al., 2019)</p>	<p>How curiosity and complexity of visual design impact the intention to scan a QR code. The initial concepts are curiosity, complexity of the visual object, and brand fit of the advertisement.</p>	<p>Scenario-based experiment (four experimental groups; high/low complexity, good/poor matching). 663 questionnaires, non-random quota selection by age and gender (Spain).</p>	<p>Analysis of covariance ANCOVA.</p>	<p>Curiosity plays a key role in shaping the intention to scan a QR code. Curious consumers are more interested in visually complex ads and have a higher intention to scan the codes. They will scan the code even when adding it to the ad intensifies its complexity. For those less interested in complex adverts, a good fit between the ad and the brand will promote scanning.</p>

Cont. table 1.

<p>(Tanner et al., 2019)</p>	<p>The role of innovation and risk aversion with regard to the adoption and use of QR codes on low-involvement products (yoghurt).</p>	<p>Qualitative study, with semi-structured interview, the selection for the study based on the self-assessment of innovation (DSI scale, 38 out of 430 people were selected) (Ireland).</p>	<p>Means-end chain analysis (MEC), content analysis, thematic analysis using NVV011 software.</p>	<p>Seeking information online prior to purchase was done outside of the retail outlet despite the existing possibilities for accessing information in the shop. Consumers will be more likely to use QRs as information about product attributes in a retail environment when they offer clear details about the product's function and purpose. The respondents did not consider QR codes as important product attributes. Marauders were negative about the purpose of the codes, showing distrust of the information provided. The codes do not provide added value (everything is on the label). The respondents were confident in their knowledge of the products and declared that they did not need anything other than what was included on the label. Innovators showed more interest in QRs, referring to them especially for local and craft products, as a way to establish a more emotional relationship between the consumer and the producer. Potential promotional offers had a strong impact on the possible use of QRs. The codes should integrate a variety of information: from the retailer, other retailers and producers, and should showcase the product in the broader food landscape.</p>
<p>(Hossain et al., 2018)</p>	<p>The influence of QR codes (usability, acceptability and feasibility) on satisfaction and intention to make an online purchase. The stimulus-organism-response (S-O-R) model.</p>	<p>Questionnaire survey. 420 respondents who have made an online purchase using QR in the past six months (China).</p>	<p>Modelling of structural equations based on covariance.</p>	<p>QR codes have an impact on the volume of online sales because they are useful (easy to use, quickly link to the shopping site, user-friendly), acceptable (graphics and text adequately convey information), feasible (convey up-to-date information). Codes have an immersive effect on the user, inducing satisfaction and leading to purchases.</p>

Cont. table 1.

(Lombard et al., 2017)	Are consumers willing to pay a higher price for additional information about a food product (extra virgin olive oil). TPB - Theory of Planned Behaviour (Ajzen, 1991), TAM - Technology Acceptance Model (Davis, 1989), WTP - willingness to pay.	Questionnaire survey of a representative sample of 1,006 respondents (Italy).	Modelling of structural equations (SEM).	Attitudes and subjective norms influence consumers' willingness to pay for a product with a QR code. Perceived behavioural control (e.g., inability to use QR) negatively affects WTP. Similarly, prior negative experience discourages consumers from using QRs (Internet connections in shops are of poor quality, codes redirect to the manufacturer's website, which is difficult to navigate on a smartphone device). Consumers described as "mavens" have a positive attitude toward using the codes. In contrast, utilitarian motivation negatively affects the propensity to use codes. Consumers with higher hedonic motivation perceive shopping as a pleasant, emotional experience, which is usually accompanied by a social aspect (shopping with friends, family). Hedonic motivation increases the positive evaluation of QRs.
(Ertekin, Pelton, 2015)	Recognizing consumer attitudes toward the use of QR codes.	Focus group interview, 16 respondents from Generation X and Y, three focus groups (US).	-	According to the respondents, it is easy to use QR codes and they provide economic benefits. They want to use them in the future, they like the convenience and quick access to information. Concerns are raised about the quality of the information provided, so they call for increased reliability and control of the information provided by users.
(Meydanoğlu et al., 2015)	The influence of QR codes on the consumer purchase decision process. A model of the buying process (Kotler, Keller, 2011).	Questionnaire method, 759 young respondents (Turkey).	Cross-case analyses, logistic regression, modelling of structural equations (SEM).	The information-seeking process with the use of QRs is initiated by the need to be influenced by marketing incentives (direct contact with the product, shopping situation, advertising) and the curiosity (which can be enhanced by a discount coupon or a reward hidden in the QR) of the consumer. The ease, speed of access and content of the information provided by the QR affect the purchase decision.
(Ozkaya et al., 2015)	Investigating the factors influencing the use of QR codes.	Online survey questionnaire, 79 respondents (QR users, students, US).	Cluster analysis, regression analysis (SPSS, GPower).	The group of practical users (information-seeking and shopping-oriented) use QR codes more often than the group of experience-oriented consumers (socializing, entertainment). Innovator and early adopter consumers do not use QR codes more often than other consumers. Those who own more electronic devices (smartphone, tablet, computer) use QR codes more often, but familiarity with modern devices alone has no significant correlation with QR use. The perceived usefulness of QRs (TAM) is not related to the consumer's use of the codes.

Cont. table 1.

(Chen, Fu, 2015)	Evaluation of the use of mobile automatic identification and data storage technologies.	Qualitative study on a sample of 76 projects subsidized by the Taiwanese government.		<p>The use of various object hyperlinks (including barcode, QR, RFID, GPS, NFC, biometrics) was compared in the context of five stages of the purchasing process. It was found that QR and RFID are the most commonly used technologies. These systems are used in the identification of products and services, automatic payments, and for product comparison. Moreover, they can stimulate needs by providing incentives and advertisements tailored to the context in which the consumer is located (identifying the consumer and where he or she is). They also influence customer loyalty and increase satisfaction (discount codes, reward points).</p> <p>The effective use of hyperlinks serves to increase sales but requires the integration of business processes assigned to the various stages of the consumer purchasing process (the cooperation of marketing, logistics, and customer service).</p>
(Okazaki et al., 2013)	How gender affects the use of QR codes from the perspective of social anxiety (Kashdan, Roberts, 2004) and the level of engagement (Mittal, 1995).	Questionnaire survey with experimental measurement, banking services (high involvement) and supermarkets (low involvement), 667 respondents (Japan).	ANOVA	<p>The results of the study confirm gender differences in loyalty behaviour, with men being more willing to take risks and seek rewards, more willing to give up privacy and security to gain benefits, compared to women, who are conservative in situations of high involvement and uncertainty.</p> <p>Loyalty promotions using QR codes can be an effective tool to engage customers, but social anxiety must be taken into consideration when designing a campaign. Social anxiety was found to negatively affect loyalty.</p>
(Sang Ryu, Murdock, 2013)	Adoption of mobile marketing communications using QR codes. TAM model.	Questionnaire survey, 340 respondents (students, US)	Modelling of structural equations (SEM).	<p>The results of the study confirm that ease of use, usability and enjoyment are key factors influencing the positive attitude and willingness to accept the QR code.</p> <p>“Market mavens” show a strong tendency to adopt the QR code, which means that shops should target their marketing strategies more towards this consumer group.</p> <p>A QR code can be an effective marketing tool, but messages should be easy to use, contain useful and exciting content and be tailored to different consumer groups.</p> <p>The innovative use of QR codes, as in the case of Home Plus (an unmanned shop in Korea), can significantly increase online sales and attract new customers.</p>

Cont. table 1.

<p>(Atkinson, 2013)</p>	<p>The identification of reasons for using mobile advertising in a retail environment. Uses and gratifications (U&G) theory.</p>	<p>Online questionnaire survey, 401 respondents (US).</p>	<p>Multiple regression.</p>	<p>The study confirms the important role of trust as a motivating factor for individuals to use mobile advertising. Trust is an important element in the decision to rely on mobile advertisements, but is viewed here as a broader, institutional influence which encompasses trust in all sources of product information.</p> <p>Both trust in the government and distrust in corporations are significant predictors of the propensity to use QR codes when purchasing sustainable products. Trust in the government is associated with a greater readiness to use the information found on a QR code. In the absence of trust in corporations, consumers reach for QR codes when they are unsure of the truthfulness of claims made by the manufacturer regarding the sustainability of products.</p> <p>Engaging in boycotting (deliberately selecting products for environmental, ethical or political reasons) positively predicts the use of QR codes in the search for information about sustainable products. Boycotting requires greater product knowledge, making the information available on QR codes particularly useful for consumers interested in sustainable products.</p> <p>People with greater awareness of new products and market information are more open to new technologies such as QR codes.</p>
-------------------------	--	---	-----------------------------	---

Source: Own compilation based on WoS and Scopus.

4. Final conclusions

The review conducted, based on 18 studies on the use of QR in consumer communications, compares the research methodologies used, sample sizes, and summarizes the findings gathered. As a consequence of the adopted course of action, a number of interesting conclusions were drawn, but it should be pointed out that the analysis has its limitations. These are due to the limitations adopted concerning the selection of the bases of the scientific publications reviewed as well as the disciplines taken into account. The review was deliberately limited to the disciplines indicated, adopting a micro-perspective of the consumer and the enterprise. The number of publications in “business, management and accounting” journals remains relatively small compared to other disciplines. In contrast, insights into consumer behaviour toward QR can provide a basis for strengthening sustainability-oriented marketing strategies.

It is anticipated that future research should develop issues regarding the value of encoded information, acceptance of the technology with respect to specific product categories, and an analysis of the benefits from the perspective of various industries (including tourism, museums, concerts, healthcare, education) and market participants (manufacturer, middleman, retailer, government, NGO).

One important challenge for the future of QR will involve security issues (QR-phishing scam) and surveillance. Some studies minimize the importance of this problem, but rather based on the opinions of consumers who trust QR codes (Atkinson, 2013; Lombardi et al., 2017; Okazaki et al., 2013). The growing awareness of the use of consumers’ personal data (e.g., consumer location, identification of the device scanning the code) is raising concerns and the need for top-down, legislative restrictions.

The advisability of using QR codes in marketing campaigns should be monitored by the effectiveness and efficiency of this customer communication channel. A prediction should be made of the benefits and costs of using pull communication with QR.

The research review identified the problem of the information desired by the consumer provided in the QR code in the situation of high/low involvement, new/familiar product, in the situation of fear and danger, trust/lack of trust, utilitarian/hedonic motivation. This is a promising and needed current of research in the context of sustainable development.

Codes are criticized for being lacking in aesthetics, an additional element that affects the complexity of the message, increasing the consumer’s cognitive overload. Next-generation codes, having original shape and form, and using colours, can be an artistic experience that invites people to scan and have an emotional relationship with the brand (*You haven’t seen QR codes like this before. They’re like works of art*, 2023).

Acknowledgements

Supported by funds granted by the Minister of Science under the "Regional Initiative for Excellence" Programme for the implementation of the project "The Poznań University of Economics and Business for Economy 5.0: Regional Initiative – Global Effects (RIGE)".

References

1. Atkinson, L. (2013). Smart shoppers? Using QR codes and 'green' smartphone apps to mobilize sustainable consumption in the retail environment. *International Journal of Consumer Studies*, 37(4), 387–393. <https://doi.org/10.1111/ijcs.12025>
2. Bashir, H. (2022). Leveraging technology to communicate sustainability-related product information: Evidence from the field. *Journal of Cleaner Production*, Vol. 362. <https://doi.org/10.1016/j.jclepro.2022.132508>
3. Chen, J.H.F., Fu, J.-R. (2015). *Creating value by object hyperlinking along the consumer buying decision process in the IoT era*. Proceedings of the International Conference on Electronic Business (ICEB) (Vol. January, pp. 183–191). <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84959198699&partnerID=40&md5=df627463e0368ad6164e7b7092af153c>
4. Dyrektywa Parlamentu Europejskiego i Rady 2009/125/WE z dnia 21 października 2009 r. ustanawiająca ogólne zasady ustalania wymogów dotyczących ekoprojektu dla produktów związanych z energią (przekształcenie) (Tekst mający znaczenie dla EOG), CONSIL, EP, 285 OJ L (2009). Retrieved from: <http://data.europa.eu/eli/dir/2009/125/oj/pol>
5. Eren, B.A. (2024). QR code m-payment from a customer experience perspective. *Journal Of Financial Services Marketing*, 29(1), 106–121. <https://doi.org/10.1057/s41264-022-00186-5>
6. Ertekin, S., Pelton, L.E. (2015). *An Exploratory Study of Consumer Attitudes Towards Qr Code Reader Applications*. *Developments in Marketing Science: Proceedings of the Academy of Marketing Science* (pp. 185–191). https://doi.org/10.1007/978-3-319-10951-0_67
7. *Global mobile traffic share by region 2024* (n.d.). Statista. Retrieved from: <https://www-1statista-1com-1s8fui2r6001f.han3.ue.poznan.pl/statistics/306528/share-of-mobile-internet-traffic-in-global-regions/>
8. Hamzah, M.I. (2023). Fear of COVID-19 disease and QR-based mobile payment adoption: A protection motivation perspective. *Journal of Financial Services Marketing*. <https://doi.org/10.1057/s41264-023-00246-4>

9. Hossain, M.S., Zhou, X., Rahman, M.F. (2018). Examining the impact of QR codes on purchase intention and customer satisfaction on the basis of perceived flow. *International Journal Of Engineering Business Management*, 10. <https://doi.org/10.1177/1847979018812323>
10. Jung, J.-H., Somerstein, R., Kwon, E. (2012). Should I scan or should I go?: Young consumers' motivations for scanning QR code advertising. *International Journal of Mobile Marketing*, 7, 25–37.
11. Le, X.C. (2022). The diffusion of mobile QR-code payment: An empirical evaluation for a pandemic. *Asia-Pacific Journal of Business Administration*, Vol. 14, No. 4, pp. 617–636. <https://doi.org/10.1108/APJBA-07-2021-0329>
12. Lombardi, A., Carfora, V., Cicia, G., Del Giudice, T., Lombardi, P., Panico, T. (2017). Exploring willingness to pay for QR code labeled extra-virgin olive oil: An application of the theory of planned behavior. *International Journal on Food System Dynamics*, Vol. 8, No. 1, pp. 14–31. <https://doi.org/10.18461/ijfsd.v8i1.812>
13. Meydanoğlu, E.S.B., Klein, M., Çilingirtürk, A.M. (2015). Impacts of QR codes on buying decision process of Turkish consumers. *International Journal of Technology Marketing*, Vol. 10, No. 3, p. 287–311. <https://doi.org/10.1504/IJTMKT.2015.070643>
14. Narang, S., Jain, V., Roy, S. (2012). Effect of QR Codes on Consumer Attitudes. *International Journal of Mobile Marketing.*, 7, 52–64.
15. Okazaki, S., Navarro, A., López-Nicolas, C. (2013). Assessing gender differences in „quick response” code loyalty promotion acceptance. *Service Industries Journal*, Vol. 33, No. 12, pp. 1165–1177. <https://doi.org/10.1080/02642069.2011.623775>
16. Okazaki, S., Navarro, A., Mukherji, P., Plangger, K. (2019a). The curious versus the overwhelmed: Factors influencing QR codes scan intention. *Journal of Business Research*, Vol. 99, pp. 498–506. <https://doi.org/10.1016/j.jbusres.2017.09.034>
17. Okazaki, S., Navarro, A., Mukherji, P., Plangger, K. (2019b). The curious versus the overwhelmed: Factors influencing QR codes scan intention. *Journal Of Business Research*, 99, 498–506. <https://doi.org/10.1016/j.jbusres.2017.09.034>
18. Osman, S., Jabaruddin, N., Zon, A.S., Jifridin, A.A., Zolkepli, A.K. (2021). Factors influencing the use of E-wallet among millennium tourist. *Journal of Information Technology Management*, Vol. 13, No. 3, pp. 70–81. <https://doi.org/10.22059/jitm.2021.83114>
19. Ozkaya, E., Ozkaya, H.E., Roxas, J., Bryant, F., Whitson, D. (2015). Factors affecting consumer usage of QR codes. *Journal of Direct, Data and Digital Marketing Practice*, Vol. 16, No. 3, pp. 209–224. <https://doi.org/10.1057/dddmp.2015.18>
20. PricewaterhouseCoopers (n.d.). *Global Consumer Insights Pulse Survey June 2023*. PwC. Retrieved from: <https://www.pwc.com/gx/en/industries/consumer-markets/consumer-insights-survey.html>

21. *Role of QR codes in advertising 2022* (n.d.). Statista. Retrieved from: <https://www-1statista-1com-1s8fui22q0008.han3.ue.poznan.pl/statistics/1372420/role-qr-codes-advertising/>
22. Rotsios, K., Konstantoglou, A., Folinias, D., Fotiadis, T., Leonidas, H., Boutsouki, C. (2022). Evaluating the Use of QR Codes on Food Products. *Sustainability*, 14, 4437. <https://doi.org/10.3390/su14084437>
23. Ryu, J., Murdock, K. (2013). Consumer acceptance of mobile marketing communications using the QR code. *Journal of Direct, Data and Digital Marketing Practice*, 15. <https://doi.org/10.1057/dddmp.2013.53>
24. Sang Ryu, J., Murdock, K. (2013). Consumer acceptance of mobile marketing communications using the QR code. *Journal of Direct, Data and Digital Marketing Practice*, 15(2), 111–124. <https://doi.org/10.1057/dddmp.2013.53>
25. Suo, W.-J., Goi, C.-L., Goi, M.-T., Sim, A.K.S. (2022). Factors Influencing Behavioural Intention to Adopt the QR-Code Payment: Extending UTAUT2 Model. *International Journal Of Asian Business And Information Management*, 13(2). <https://doi.org/10.4018/IJABIM.20220701.oa8>
26. *Takich kodów QR jeszcze nie widzieliście. Są jak dzieła sztuki* (2023, czerwiec 9). Antyweb. <https://antyweb.pl/kody-qr-dziela-sztuki>
27. Tanner, S.A., McCarthy, M.B., O'Reilly, S.J. (2019a). Digital labelling in the retail environment: A domain-specific innovativeness perspective. *International Journal Of Retail & Distribution Management*, 47(12, SI), 1336–1352. <https://doi.org/10.1108/IJRDM-08-2018-0175>
28. Tanner, S.A., McCarthy, M.B., O'Reilly, S.J. (2019b). Digital labelling in the retail environment: A domain-specific innovativeness perspective. *International Journal of Retail and Distribution Management*, Vol. 47, No. 12, pp. 1336–1352. <https://doi.org/10.1108/IJRDM-08-2018-0175>
29. Trivedi, R., Teichert, T., Hardeck, D. (2020). Effectiveness of pull-based print advertising with QR codes Role of consumer involvement and advertisement appeal. *European Journal Of Marketing*, 54(1), 145–167. <https://doi.org/10.1108/EJM-06-2018-0383>
30. Vatanparast, R., Butt, A.H. (2009). *Factors Affecting Use of Mobile Advertising: A Quantitative Study*. 42nd Hawaii International Conference on System Sciences, 1–8. <https://doi.org/10.1109/HICSS.2009.214>