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Diverse locations for QR code usage

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Factors affecting consumer usage of QR codes

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Abstract

In recent years, various institutions have adopted the use of two-dimensional bar codes, also known as QR (quick response) codes, for encoding information such as URLs that can be read by smartphones, digital tablets and other electronic devices. These codes can serve as a vehicle to evoke a consumer response or some type of behaviour. Their main benefit is that users of smartphones are alleviated from the tedious task of typing and searching to access information. This paper provides the results of a survey study of college students' awareness and use of QR codes. The findings indicate that the purpose of usage is significantly related to QR code usage rate. Practical users utilize QR codes more than experiential users and there is a positive relationship between electronic device ownership and QR code usage. Interestingly, being an early adopter has a negative relationship with QR code usage. Additionally, perceived usefulness of the QR code and up-to-date electronic device knowledge do not have significant relationships with QR code usage rate. *Journal of Direct, Data and Digital Marketing Practice* (2015) **16**, 209–224. doi:10.1057/dddmp.2015.18

Introduction

The use of Quick Response (QR) codes has proliferated in the marketing/advertising environment concomitant with the explosive growth in smartphone penetration. This has further propelled the growth of social media, and marketers are rushing to take advantage of this trend. According to comScore.com, '20 million mobile phone owners in the US used their devices to scan a QR code in the three-month average period ending October 2011'.¹ Location varied when scanning a QR code, including home (59.4 per cent), a retail store (44 per cent), a grocery store (26 per cent), at work (21.4 per cent), outside or on public transportation (11.2 per cent) and while in a restaurant (10 per cent), indicating that users are exposed and respond to QR codes in diverse environments relevant to marketing purposes. Moreover, QR codes add richness to the consumer enquiry and for brands to differentiate product value.²

Despite their prevalence and successful examples of marketing applications, the number of studies on QR codes is limited. Most of the studies in the literature on QR codes focus on innovative uses of this

Focus on current users

technology.^{3–7} However, apart from a few studies that examine the adoption of QR codes,⁸ the factors affecting the usage of QR codes have been overlooked. We focus on consumers who have already adopted QR codes. Thus, we examine ‘current’ users who are different from the ‘potential’ users examined in other studies.⁸ Examining the current users and increasing their usage rate are highly important for companies that promote their products through QR codes. Increasing QR code usage requires exploring the potential factors that would affect the QR code usage rate. However, to the best of our knowledge, there are only a few studies that are tangentially related to this important research question.^{9–12} This study therefore aims to fill this gap by exploring the factors that affect the use of QR codes.

Trademarked by Denso Wave

QR code (abbreviated from Quick Response Code) is the trademark for a machine-readable optical label that contains information about the item to which it is attached (see Figure 1). A QR code uses four standardized encoding modes (numeric, alphanumeric, byte/binary and kanji) to efficiently store data — extensions may also be used. QR codes have been around since the mid-1990s, when they were invented in Japan, and they are a registered trademark of Denso Wave. The company has chosen not to exercise its patent rights, thus encouraging widespread use of the technology.¹³

Flexible and universal

QR codes have characteristics that allow companies to share information with their customers in a quick and hassle-free way. First, QR codes have the capacity to handle different types of data, for example numeric and alphabetic characters, allowing the encoding of URLs and other sorts of linkages to the original message. Second, they have superior information storage capacity when compared to one-dimensional barcodes. Third, they have flexible representation — shapes and colours of modules can be changed, even allowing for artistic representation. Finally, QR

Figure 1: QR codes use four standardized encoding modes

codes can be read by any smartphone, tablet or laptop with a camera, using freely available software (*Source*: Denso Wave Incorporated, 2013). On most phones purchased in the United States, one must download a free app (application) in order to read the QR code, although some phones have one pre-installed.

Adopted by museums, schools, real estate

By scanning the QR code, a consumer can benefit based on the offerings that are embedded in the code. A few remarkable uses of QR codes include opening a web page, translating a webpage to a preferred language (<http://qrpedia.org>), playing a multi-media message or even placing a call.¹⁴ QR codes have found various uses in today's technology-driven spaces. For example, most US libraries and museums have adopted QR codes for providing subject orientations for visitors, linking exhibits with audio tours and connecting rooms to reservation forms.⁵ Some innovative classroom uses of QR codes include attendance checking, adding how-to videos for maths problems by adding QR codes to homework sheets¹⁵ and embedding online material in learning zones in an English-language learning system.¹⁰ In the real estate industry, QR codes are used on 'for sale' signs to lead to videos showing the inside of houses and realtor contact information.¹⁶ Most airlines today have converted to scanning boarding pass information with QR codes. However, the industries that have most capitalized on this technological development are marketing and advertising.¹⁷

Tracking and convenience

A QR code can be easily manufactured without cost via an application or a website. As a result, advertising strategies using QR codes have become popular. Due to their flexible presentation, QR codes can be placed on point-of-purchase displays and publications, on product packaging, business cards, in television ads, on ticket stubs or on direct mail,¹³ and provide a valuable means for consumer communication for marketers. Another important characteristic of QR codes is the possibility of tracking user behaviour and providing statistics (eg with Google Analytics) about each code. Analytics record how many times a code has been scanned, location of individuals scanning, user interests associated with a particular code, etc. Furthermore, these codes can be used by creative agencies to create curiosity among users regarding their brand campaign by simply hiding rewards and discount offerings within a QR code. The major appeal to consumers can be the elimination of the need to carry around coupons or store cards.

Usability issues

As with many new technologies, however, QR codes have some usability issues. For all their opportunities and strengths, they have a straightforward weakness: requiring a smartphone or a tablet with camera. This simple requirement eliminates 40 per cent of mobile subscribers in the US.¹⁸ Since QR codes require users to request information, communication opportunity is limited by the consumers' acquaintance with QR codes and their uses. If the user does not have the appropriate software to scan QR codes, having a smartphone alone does not mean access to embedded information. For these reasons, QR codes can be regarded as a transitional technology; future phones will automatically link data with users in a more seamless way.

Limited previous research

Literature review

The QR code technology is new and it has received very little research. Early research into QR codes has been on the utilization of the technology in various alternative scenarios including, but not limited to, academic libraries and museums,^{4,5} and these studies generally explored the innovative uses of the technology for enriching and facilitating visitor experience, utilization for visually impaired and blind people,³ and application in augmented reality applications⁶ and classroom environments.¹⁹ Later research included using QR codes in mobile advertising,¹⁴ especially integrating mobile devices into multi-channel or cross-media campaigns¹⁴ and retailing.²⁰

Role of technology acceptance

Due to the highly interactive character of QR code use, user intention towards technology acceptance and adoption is of particular importance in understanding QR code success in advertising. Any new technology needs to be perceived as being useful and easy to use in order for it to be accepted. Researchers in business and communication disciplines have long sought the dynamics of technology acceptance. The Technology Acceptance Model (TAM) can be used to explain why some technologies are adopted while others are ignored.^{21,22}

Perception of ease of use

Behavioural intention, a precursor to technological adoption, is determined by users' attitude and perceived usefulness.²³ To be considered useful, the technology must have an ease-of-use aspect to it. Regarding the perceived ease of use, research reports are quite limited, but findings indicate that educated college students generally find QR codes easy to use. In a classroom experiment with 20 students and three instructors, Li, Tan and Chou¹⁰ found that the majority of the subjects found using QR codes in a classroom management system very easy. In a focus study with 28 library patrons, Lo and Coleman²⁴ found perceived ease of use regarding QR codes to be high, and they suggested that it could be enhanced by providing instructions for those who are unfamiliar with the technology.

Above-average rating

TAM posits that perceived usefulness is a fundamental concern that determines behavioural intention to adopt technology. Perceived usefulness is defined as the subjective probability that the use of a given information system enhances user performance in a desired context.^{21,22} Again, a limited number of studies reported above-average values of perceived usefulness regarding QR code usage among college students.^{10,11} In an experimental study to augment paper-based reading activity with direct access to digital materials via use of QR codes, Chen, Teng and Lee²⁵ also reported that 77 college students rated their agreement for ease of use with an average of 3.6 on a 1 to 5 scale.

Social dimension of QR code usage

QR codes are interactive technologies and their use can be integrated with online social sharing and entertainment. For example, entertainment videos can be hyperlinked to QR codes for the user to share with their network. Within a video game application, random rewards can be embedded in the game with QR codes to be unlocked by players. Shin, Jung and Chang¹¹ reported that the interactive features of QR codes that connect users had a strong positive impact on intention to use. This finding implies that QR codes are not only perceived as a commerce channel, but

also as a social venue through which users can interact. QR code activity therefore entails much more than seeking information: it is perceived as a social activity comprising entertainment, education and socialization.

Early adopters

The literature reports consistent growth in the use of QR codes over the past 10 years. Heltman¹⁶ reported that by the second quarter of 2011 the use of QR codes in the United States jumped 9840 per cent from the second quarter in 2010. Use and adoption on the continent jumped 120 per cent in the last six months of 2010 (*Source*: Research and Markets). The Forrester report indicates that only 5 per cent of American consumers scanned a QR code during a three-month period in mid-2011. Nonetheless, these early adopters — mostly younger, more affluent males — number about 14 million and, among them, nearly 20 per cent (or 2.8 million) made a purchase after scanning one of these codes, according to research firm Chadwick Martin Bailey.²⁶

Hypotheses

Practical and experiential uses

Retailers utilize QR codes to offer consumers a more enjoyable shopping experience (non-utilitarian) as well as shopping information and convenience (utilitarian) via mobile phones.^{27,28} Building on these studies, we differentiate between the practical and experiential users of QR codes. Practical users utilize QR codes for activities that are directly focused on the product, such as gathering information about the product or price. Experiential users, on the other hand, are involved in activities that are indirectly related to the product, such as socializing and accessing entertainment media.

Fit with practical uses

The main purpose of QR application in advertising campaigns is to provide a direct link to the promoted website or product information. Consumers are therefore provided with a shortcut to information, have easier access to shopping options, and can even compare and contrast buying alternatives. This aspect of QR codes aligns well with the usage purpose of practical users who are focused on collecting product information and making a purchase. On the other hand, experiential users can also benefit from the QR codes that enable them to socialize and access entertainment data. However, the product-focused nature of QR codes makes them a better fit for practical users. We therefore hypothesize that:

H1: Practical users have a higher QR code usage rate than experiential users.

Lighthouse customers or trendsetters

QR codes are a new technology. As with many new technological advancements, they have users that adopt the technology early in its market lifecycle and users that will adopt at a later time. An *early adopter* or *lighthouse customer* is an early customer of a given company, product or technology — in politics, fashion, art and other fields, this person would be referred to as a trendsetter. The term originates from Everett Rogers' Diffusion of Innovations.²⁹ Early adopters are most likely to be active users.³⁰ Early adopters are typically described as curious, adventurous consumers

who buy first, talk fast and spread the word to others about the pros and cons of what they have purchased.

The 16 per cent

Rogers illustrated the diffusion of innovation across populations with a normal distribution or bell curve in which innovators and early adopters made up about 16 per cent of the consumers who will adopt an innovation. This does not mean that 16 per cent of any given population are early adopters. Rather, they are a cultural phenomenon identifiable only by how they perform. They recognize the different or latent values and benefits of a product or as it relates to functionality, usability and sociability. Since they have more background information on technological developments and are more curious about new technologies, they are more likely to research them and are more willing to give innovation a try.

Innovativeness and novelty-seeking

Venkatesh, Thong and Xu³¹ discussed that innovativeness and novelty-seeking would contribute to hedonistic motivations to adopt a new technology. Innovativeness is defined as the degree to which an individual is receptive to new ideas and makes innovation decisions independently.³² Novelty-seeking is the tendency of an individual to seek out novel information to use a product.³³ Holbrook and Hirschman argued that innovativeness and novelty-seeking can add to the hedonic motivation to use a product and their hypothesis was supported. Therefore, we predict:

H2: Being an early adopter has a positive relationship with QR code usage rate.

Predictors of intention to use

Prior research has shown that consumer innovators are important groups to target when launching new products and services.³⁴ Consumer innovativeness is defined as an individual's willingness to investigate and adopt products, services or ideas.³⁵ Consumer innovativeness explains consumer interest in exploring various media channels for market information and new developments in the marketplace.³⁴ Consumer innovativeness is a strong predictor of consumer intention to use interactive electronic media for shopping.³⁶ This relationship has been empirically confirmed in the context of mobile shopping.³⁷

Device and QR code usage linked

Accordingly, we expect a positive relationship between electronic device ownership (mobile phone, computer, tablet, etc) and QR code usage because, as discussed above, innovative consumers are more inclined to use interactive electronic media for shopping (eg electronic devices) and to explore various information channels (eg QR codes). Additionally, we expect a positive relationship between up-to-date electronic device knowledge and QR code use. The reason is that innovative consumers are interested in exploring product information and investigating new products (eg up-to-date electronic device knowledge) and they are inclined to explore various information channels (eg QR codes).

Therefore, we pose the following hypotheses:

H3: Electronic device ownership has a positive relationship with QR code usage rate.

H4: Up-to-date electronic device knowledge has a positive relationship with QR code usage rate.

Usefulness and intention to use

A considerable body of TAM research has empirically confirmed the positive effect of perceived usefulness on consumer attitudes towards mobile services.^{21,22,38} In this context, perceived usefulness refers to the degree to which a person believes that using a particular system would enhance his or her job performance²¹ (p. 320). Perceived usefulness has been shown to positively influence consumer intentions to adopt a wide array of mobile services.³⁹ Ryu and Murdock⁸ found that perceived usefulness positively affects consumers' intent to adopt QR codes.

As the QR code is one type of mobile communication, we expect that, when consumers find QR codes useful, they will use them more. Thus, we propose the following hypothesis:

H5: Perceived usefulness has a positive relationship with QR code usage rate.

Methodology

Sample and data collection

Data was collected with an electronic survey conducted at a large university in the western United States. Participants were college students ($N = 174$) who were recruited from undergraduate classes in business and offered extra credit in alignment with the ethics guidance committee's approval. The sample was monitored for QR code familiarity and usage — participants who did not know about the existence of QR codes were excluded from further analysis. There were 79 remaining participants who used QR codes, of whom 34 were males and 44 were females. Even though our sample size decreased when we focused on those who use QR codes, *post-hoc* statistical power analysis for multiple regression with the sample size of 79 showed that we had enough observed statistical power (power = 0.88, observed $R^2 = 0.20$, number of predictors = 8) to make inferences about the significance of the relationships. The *post-hoc* power analysis was conducted using the software package GPower.⁴⁰

Ethnic profile

Participants were between 20 and 39 years old (M age = 24.13). The ethnic breakdown was 32.1 per cent Hispanic/Latino, 34.6 per cent Asian, 23 per cent White, 1.4 per cent Native Hawaiian, 1.3 per cent Black, and 1.3 per cent American Indian or Alaska Native. The sample characteristics are summarized in Table 1.

Measures

Participants completed an online survey following the two screening questions regarding QR familiarity. The first question presented a QR code symbol (see Figure 1) and asked the participants to indicate what it was in an open-ended question. The second screening question asked whether the participants had ever used one of these. The response scale was binary (Yes/No) with instructions to either continue to the demographic questions and exit or continue with the rest of the survey.

Usage and rating

The dependent variable was the QR code usage frequency and it was measured with an open-ended question: '*How many times have you used*

Table 1: Sample Characteristics

	%
<i>Electronic early adopter profile</i>	
Owned smartphones	80
Self-identified early adopter	49
Early adopter by gender, age, ethnicity	No difference
<i>QR code awareness</i>	
Correctly identified the icon	43
Called it a bar code	16
Don't know/not sure	29
<i>QR code usage</i>	
Have used QR codes (of total sample)	45
Of those who used it, used it <5 times	56
Of those who used it, used it 5–10 times	39
Of those who used it, used it >10 times	5
<i>Characteristics of sample</i>	<i>N</i> = 174
Age	23.86 (mean)
Gender (male)	46
Gender (female)	54
Ethnicity (Asian)	36
Ethnicity (Hispanic/Latino)	31
Ethnicity (Caucasian)	25
Other	5

this in the past year?” The usage purpose was measured similarly, with an open ended question: ‘What do you use QR code for?’ To assess participants’ perceived usefulness of the QR code participants rated this on a scale from 1 to 10, 1 indicating *not useful at all* and 10 *extremely useful*.

The dimensions of consumer innovativeness include early adopter, electronic device ownership and up-to-date electronic device knowledge.⁴¹ Questions were included to measure students’ perceptions of the extent to which they perceived themselves as electronic early adopters or opinion leaders among their friends, adopted from Goldsmith and Hofacker.⁴¹ Questions that measured consumer innovativeness included ‘*In general, I am among the first in my circle of friends to buy new electronics when it appears*’ (early adopter), ‘*Compared to my friends, I own few electronics*’ (electronic device ownership) and ‘*I know the names and features of the new electronics before other people*’ (up-to-date electronic device knowledge). A 5-point Likert-type response scale was used for each item where 1 = strongly disagree and 5 = strongly agree.

Even though these are dimensions of the higher-order construct consumer innovativeness, we believe they are different constructs. Accordingly, we tested the dimensions of consumer innovativeness separately and found that they had different effects on the QR code usage rate. Additionally, we tested consumer innovativeness as a higher-order construct and it did not have a significant effect on QR code usage rate. This further proves that the dimensions of consumer innovativeness need to be tested separately. Thus, we tested the effect of early adopter, electronic device ownership and up-to-date electronic device knowledge separately. Finally, the survey included a battery of demographic measures, including age, gender, ethnicity and whether the subject was the first in their family to go to college.

Selecting for device attitude

Innovativeness has different effects

Data Analysis

Data were analysed in SPSS (version 20) with a multivariate regression to test the relationship between the independent variables (QR code usage purpose, early adopter, electronic device ownership and up-to-date electronic device knowledge) and the dependent variable (QR code usage rate). A cluster analysis was used to group the QR code usage purpose that was indicated by the respondents. The two groups revealed by the cluster analysis were practical users and experiential users. The usage purposes indicated by the users that fall into the practical user group include looking up information about the product, finding the product website, shopping, conducting product research and checking prices. The usage purposes indicated by the experiential users include adding friends, trying out applications, checking advertisements, sharing the advertisements and accessing entertainment media. QR code usage purpose was coded as a dummy variable where experiential users were coded as 0 and practical users as 1. Age, gender and race were added as control variables.

Role of ethnicity

In order to find out more about what drives the success of QR code marketing efforts, we included age and gender control variables. There has been little investigation in prior literature into the effect of demographic factors, such as age and gender.⁴² Age has consistently been shown as an important factor determining perceived ease of use and technology adoption decisions.³⁸ A recent study has shown that controlling for demographic characteristics, older adults were only 13 per cent as likely as younger adults to have used a QR code.²⁸ Hispanics make up a significant portion of our sample. Previous studies indicate that a higher percentage of Hispanics own smartphones compared to the national average,⁴³ and are more likely to be the first to buy a smartphone⁴⁴ and to text, download music, play games, and access social networking than all cellular users.⁴⁵ These findings indicate that ethnicity may be an important factor. Thus, in addition to age and gender, we also included ethnicity as a control variable.

Independent variables

We also tested for multi-collinearity. The highest variance inflation factor value for the independent variables reached up to 1.41, which is well below the cut-off point of 10 advocated.⁴⁶ This suggests that our results are not biased by multi-collinearity. The VIF scores of the variables are as follows: purpose = 1.10, early adopter = 1.32, electronic device ownership = 1.41, up-to-date electronic device knowledge = 1.32, usefulness = 1.22, age = 1.06, gender = 1.29, race = 1.11.

Results**Identifying clusters**

Because the user categories were created with the usage purpose variable, we first tested whether our categorization of the users as practical or experiential actually appears in the data. The results of the cluster analysis in SPSS revealed that our categorization was consistent with the data. Practical users (cluster 1) comprised 67 per cent ($N = 51$) of the sample whereas the experiential users comprised 33 per cent ($N = 25$). The cluster quality was fair, with a silhouette measure of cohesion and separation of 0.2. The silhouette measure of cohesion and separation between 0.2 and 0.5 indicates reasonable evidence of cluster structure.

Table 2: Multivariate regression results

	Standardized coefficients Beta	t	Sig.
(Constant)		-0.08	0.94
Purpose	0.28	2.42	0.02
Early Adopter	-0.32	-2.51	0.01
Electronics Device Ownership	0.27	2.03	0.05
Electronic Device Knowledge	0.08	0.64	0.53
Perceived Usefulness	0.10	0.84	0.41
Age	0.20	1.78	0.08
Race	0.01	0.11	0.91
Gender	-0.11	-0.85	0.40

Lack of comparison points

The dependent variable, QR code use rate among the subjects, ranged from 0 to 30 times a year with $M = 4.91$, $SD = 5.02$. QR code use among consumers is generally low due to the novelty of the technology. Since there are no nationwide studies regarding the use of QR codes, there is no base rate that can be used for comparison. Thus, speculatively speaking, the QR code familiarity and use findings in our sample indicated that about 44 per cent of the college students were familiar with QR codes and 68 per cent of that portion used them for information-seeking and purchasing purposes. They also used them more often than the category of users who utilized the technology for social and causal purposes.

Practical, not casual, use of QR codes

The multivariate regression analysis results in Table 2 indicate that the dummy-coded QR code use purpose construct has a positive relationship with QR code usage rate ($\beta = 0.28$, $p < 0.05$), indicating that practical users utilize QR codes more than casual users, supporting H1. Interestingly, early adopter construct had a negative relationship with the QR code usage rate ($\beta = -0.32$, $p < 0.05$), indicating that the consumers who are interested in buying new electronic devices when they become available use QR codes less often. Thus, H2 is not supported.

Device usage v QR code usage

Electronic device ownership has a positive relation with QR code usage ($\beta = 0.27$, $p < 0.05$). This indicates that people who own more electronic devices use QR codes more, supporting H3. We note that electronic device ownership is not limited to smartphone ownership, since all of the respondents in the sample use QR codes. However, those who own more electronic devices, perhaps due to their familiarity with these devices in general, use QR codes more. Interestingly, up-to-date electronics device knowledge does not have a significant relationship with QR code usage ($\beta = 0.08$, $p > 0.05$), indicating that up-to-date knowledge about electronic devices does not effect QR code usage. Thus, H4 is not supported.

Ethnicity not significant in usage

Another interesting finding is that perceived usefulness does not have a significant relationship with QR code usage ($\beta = 0.10$, $p > 0.05$), and thus H5 is not supported. The control variables, age ($\beta = 0.20$, $p > 0.05$), ethnicity ($\beta = 0.01$, $p > 0.05$) and gender ($\beta = -0.11$, $p > 0.05$), do not have significant relationships with QR code usage rates at the $p = 0.05$ level. Even though ethnicity did not have a significant effect on the results, due to the findings in the literature about the differences in smartphone use by Hispanics, we compared the Hispanics versus Non-Hispanics in the

sample. The results above show that ethnicity is still not significant ($\beta = 0.14, p > 0.05$), indicating that the results for Hispanics versus Non-Hispanics are not affected by the ethnic difference. Additionally, the significance and direction of all the effects are the same. These findings support our conclusion that ethnicity does not have a significant effect on our results.

Discussion

Practical uses dominate

The purpose of this paper was to identify the factors that contributed to the use of QR codes among consumer populations. Our findings show that practical users who are focused on product-related activities, such as collecting product information or making purchases, use QR codes more frequently than experiential users who primarily focus on socialization and entertainment. We also found that people who own more electronic devices used QR codes more. Interestingly, QR code usage does not have a statistically significant relationship with either up-to-date electronic device knowledge or perceived usefulness. Another interesting finding is the negative correlation between early adopters and QR code usage. To test whether this inverse relation could be explained by the perceived usefulness of the technology among early adopters, we tested the correlation between perceived early adoption of technology and QR code usefulness, and found that the two did not have a significant relationship ($r = 0.37, p = 0.33$, two-tailed).

Purchasing-related activities

Practical users appear to be more specific in their use of QR codes or more focused on accomplishing a goal in their usage. Looking up information about the product, finding the product website, shopping, conducting product research and checking prices are activities that can be perceived as having closer proximity to purchase behaviour. For example, Bucklin⁴⁷ found that consumers' checking of ads for information increased from 14 per cent for purchases of low-priced products (\$5 to \$9) to 46 per cent for purchases of high-priced products (more than \$50). Consumers engaging in information-seeking activities, in other words practical QR code users in our study, exert explicit efforts to collect information about products they plan to purchase and even use QR codes to complete purchases.

Electronic ownership

The ownership of electronic devices (other than smartphone ownership) predicted more frequent use of QR codes. The electronic ownership dimension of consumer innovativeness is one of the strongest indicators of curiosity and experience with new technologies. Our findings are in line with the findings of Lin⁴⁸ who found that technology ownership has been one of the strongest predictors of laptop adoption. The potential reason for this is that people who have electronic devices are more likely to have experience with technology and therefore have stronger self-efficacy to try out new or different applications. In fact, self-efficacy has been shown to be an important predictor of use of web-based information systems.⁴⁹

QR codes not a novelty for early adopters

A counter-intuitive finding of this study is the negative relationship between being an early adopter and QR code usage rate. This is contrary to most of the previous findings in the literature.^{37,50} One would expect early adopters to use QR codes more due to their fondness for new technology. Thus, our finding

may be an important indicator of the perception of QR codes in the eyes of early adopters. Even though QR code technology is perceived as a relatively new technology, apparently it is not considered novel by early adopters. This may be due to the fact that early adopters are now focused on the next new technology, while the rest of the population is just getting accustomed to QR codes. The negative relationship found between consumer innovativeness and QR code adoption⁸ supports this argument.

Loss of novelty factor

Another counter-intuitive finding is the non-significant relationship between up-to-date electronic ownership and QR code usage. As discussed previously, the statistical power of the sample is high enough (0.88) to make inferences about the significance of the relationships. Thus, the non-significant relationships among the variables in our study are not due to sample size, but rather to the nature of their relationships. The non-significant relationship between up-to-date electronic ownership and QR code usage indicates that people who are knowledgeable about new technological products do not use QR codes more. This interesting finding can be explained by the shifting focus of those who have up-to-date knowledge about new technological products. They may have used QR codes in the past, but now they may be focused on newer technologies to collect information about the products. Findings on both early adopters and up-to-date electronics knowledge indicate that the QR code is losing its novelty factor among a certain segment of customers. Thus, QR code content providers should either find novel ways to attract these customers or focus on the rest of the population.

Usefulness does not increase usage

In contrast to earlier findings, perceived usefulness of the QR codes did not have a significant relationship with QR code usage rate. Previous studies indicated a positive effect of perceived usefulness on consumer attitudes towards mobile services,^{21,22,38} the adoption of mobile services³⁹ and the intent to adopt QR codes.⁸ However, our study does not indicate a significant relationship between perceived usefulness and QR usage rate. The reason could be the difference between the intent to adopt and the usage rate. Our sample includes people who are already using QR codes; thus, they have already adopted the technology. Our findings indicate that once consumers adopt QR codes, the usefulness does not increase usage rate. The possible reason could be expectations of the consumers after they decided to adopt the technology. The consumers may perceive usefulness as an inherent feature of the QR code that they take for granted after adoption and require more and/or different features to increase their usage of QR codes.

Low familiarity and usage

Another finding of this exploratory study is the low familiarity and usage of QR codes in general. This could be attributed to the novelty of the technology for the general population (even though it is no longer novel for early adopters) and relatively low smartphone penetration among the college population at the time of data collection for the present study. Despite the fact that college students are generally more curious about smartphones and innovative uses of the technology, they are less likely to be able to afford the higher costs associated with these technologies. This is reflected in the statistic that the majority (66 per cent of the sample population) did not own a smartphone. However, we expect that the use of QR codes will increase as smartphones become more affordable. QR code technology may have the

potential to attract consumers who value convenience and innovation. The notion about adoption being a factor in the success of providing electronic responses may be supported by wider adoption of smartphones and information-enhanced advertising campaigns.

Managerial implications

More benefits required

The rate of adoption for QR codes has not been stellar among smartphone users overall. Thus, marketers need to consider incentivizing the behaviour of accessing QR codes to motivate potential users. If consumers do not perceive apparent advantages to using these codes, the likelihood of an increase in the adoption rate would be staggered at best. Our study indicates that perceived usefulness does not increase the usage rate of QR codes. This finding indicates that marketers should offer more attractive benefits when executing a campaign using QR codes.

Link to purchase

Our findings indicate that there are two distinct types of users: practical users and experiential users. Marketers would do well to address the needs of practical users since they not only outnumber experiential users, but they are also much closer to purchase and, at times, complete their purchase using their smartphones and the corresponding QR codes. For this type of customer, firms should design content that has an option to buy the product. An important implication of our findings, therefore, is that if campaigns target these users successfully, it could lead to increased sales. In contrast, the second user type, experiential users, are engaged in activities that could be referred to as social, such as adding friends, trying out applications, sharing advertisements and accessing entertainment media. Marketers should seriously consider appealing to the experiential user and provide entertaining content to attract these customers. They could be targeted for community-building and word-of-mouth marketing purposes, such as promoting viral campaigns or creating brand community blogs.

Novelty and innovation

Our results indicate a negative relationship between early adopters and usage. This may indicate that QR code use has advanced beyond the early adopter consumers who are moving on to other technological advances. Thus, QR codes may not be the correct tool for a marketing campaign targeted to early adopters. Alternatively, marketers may implement more novel ways to push QR codes or include additional innovations to attract early adopters.

Links to websites

Additionally, marketers, in using QR codes within their communication strategies, should distinguish between the members of their target audience. For product users and in attracting new users, accessing QR codes should result in access to practical items that can nudge customers towards a product purchase. Customers should be able to quickly access websites containing information about the product (eg description, prices, abbreviated reviews and the ability to check out with a purchase) as well as make a purchase.

Limitations and future studies

Students adopt new technologies

The first limitation of this study is collecting the data from college students. Even though it is common to collect data from students on QR code research,

college students may not represent the general population because post-secondary education typically increases one's exposure to technological innovations and the likelihood of being an early adopter. We addressed this limitation by focusing on usage rate, rather than the intent to adopt. The students are expected to have a higher intention to adopt new technologies compared to the general population. However, examining the usage rate focuses on consumers who actually use QR codes. These are the ones who have already adopted the technology. Thus, our student sample is more similar to the general population who use QR codes than to a population of potential users. Thus, our student sample represents the general population of QR code users better than previous studies that focuses on intent to adopt. However, a further study that examines the factors effecting QR code usage in different customer segments could be beneficial.

Customer innovativeness

The second limitation is the use of consumer innovativeness dimensions. We examined the effects of the customer innovation dimensions as separate independent variables and showed that they behave differently. This is an important finding because when we tested them as items of the higher-order customer innovation construct, their effect was not significant. The positive, negative and non-significant effects of the individual items explain the non-significant effect of the higher-order construct, indicating that the individual positive and negative effects of the lower-order constructs cancel each other out and lead to an overall non-significant effect. We also checked for multi-collinearity and the results indicated that these differences are not due to the shared variance among these independent variables. Thus, our choice of using the customer innovativeness dimensions separately is justified. However, this left us with only one item per variable. For future studies, it would be better to test the early adopter, electronics ownership and up-to date electronics ownership constructs with three or more items.

Moderated relationships

Our results do not indicate a significant relationship between perceived usefulness and usage rate of QR codes. However, previous studies in the literature indicate a positive relationship between usefulness and mobile services.³⁹ This may be an indication of potential moderating variables. Thus, future studies may focus on the factors that moderate the relationship between perceived usefulness and the usage rate of QR codes.

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