

Albăstroi, Irina; Felea, Mihai

**Article**

## Enhancing the shopping experience through QR codes: the perspective of the Romanian users

Amfiteatru Economic Journal

**Provided in Cooperation with:**

The Bucharest University of Economic Studies

*Suggested Citation:* Albăstroi, Irina; Felea, Mihai (2015) : Enhancing the shopping experience through QR codes: the perspective of the Romanian users, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 17, Iss. 39, pp. 553-566

This Version is available at:

<http://hdl.handle.net/10419/168933>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<http://creativecommons.org/licenses/by/4.0/>

## ENHANCING THE SHOPPING EXPERIENCE THROUGH QR CODES: THE PERSPECTIVE OF THE ROMANIAN USERS

Irina Albăstroiu<sup>1\*</sup> and Mihai Felea<sup>2</sup>

<sup>1)2)</sup> Bucharest University of Economic Studies, Romania

---

### Please cite this article as:

Albăstroiu, I. and Felea, M., 2015. Enhancing the shopping experience through QR codes: the perspective of the Romanian users. *Amfiteatru Economic*, 17(39), pp. 553-566

---

### Abstract

The progress registered in the field of information and communication technologies has induced significant changes in the purchasing behaviour of the consumers who nowadays want simultaneous use of online and offline channels within the same shopping experience. QR Code (Quick Response) is among the emerging technologies that retailers can implement for adapting to these changes.

Through reviewing the literature, the article firstly clarifies the characteristics and applicability of the QR codes, especially in retail, and then presents the results of an exploratory research conducted among Romanian users regarding their attitude and interest in QR codes. The objective of the research was to identify the degree of usage, the willingness of the Romanian people to use codes in the buying process and also their perception about the functionality and usefulness of the codes. This is a pioneering work for the Romanian literature, because there aren't other studies that explore issues concerning the use of QR codes in the buying process. Results of the study indicated that respondents know the applicability of QR codes and have used codes for accessing information about products and for online purchases and they consider that QR codes contribute to the improving of the shopping experience.

**Keywords:** QR (Quick Response) code, technology, mobile device, mobile tagging, shopping experience, buying process.

**JEL Classification:** O33, L81.

---

### Introduction

QR (abbreviated from *Quick Response*) code is a *two-dimensional barcode* that encodes information, according to International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), QR code being clearly defined and published as an *ISO standard* (ISO/IEC, 2006).

---

\* Corresponding author, **Irina Albăstroiu** – irina.albastroiu@com.ase.ro

The QR code system was invented in 1994 by Denso Wave Inc. – a division of Denso, subsidiary of the Toyota Motor Corporation - and is a trademark of this Japanese company; nevertheless, the use of QR codes is free of any license. It was originally designed for the use in automotive industry and its purpose was to track vehicles components during manufacture, as mentioned by Kan, Teng and Chen (2011), but the widespread use of mobile devices has led to a broad applicability of the code and has enabled the use of QR code in areas such as trade (especially retail), marketing, logistics, education, tourism, entertainment etc.

The main advantage of the QR code over a normal bar code is that two-dimensional barcode *contains information in both vertical and horizontal directions*, whereas a classical barcode has only one direction of data, usually the horizontal one (Rouillard, 2008). This means substantially greater amounts of information (textual information, numerical values and binary data) can be stored within the QR code. The information is decoded by a *smartphone with an embedded camera* and a *code reading software* installed. The explanation of the term used to name this code (Quick Response) lies precisely in the fact that it allows *quick access to information* (such as websites addresses, e-mails, phone numbers, geographical coordinates etc.) through mobile devices.

This two-dimensional barcode allows the rapid transmission of information via mobile devices and timely access to relevant and useful content in the buying decision-making process. Due to the *convenience, user friendliness, customer-driven information* provided (Shiang-Yen, Foo and Idrus, 2011), there is various possibilities to use QR codes for different approaches. QR codes can be applied on labels or wrappings of products, on flyers, brochures, catalogs, billboards, posters, adverts in newspapers/magazines, transporting tickets, invitations to events, greetings cards, business cards etc., enabling users to access information about products, promotional offers or events, allowing them to obtain coupons/vouchers or to perform direct downloads over the Internet (of videos, mobile applications, ringtones etc.), to make mobile payments, to quickly access corporate websites, social media pages or online shops (where they can buy the products they want), to receive a password that allows connection to a wireless network, to find contact information for individuals and organizations or to obtain indications on certain geographical locations (Ebner, 2008; Shiang-Yen, Foo and Idrus, 2011; Wara and Dugga, 2014).

Considering the classification of existing studies in the relevant literature regarding the QR codes, developed by Kleine, Bayrak and Çilingirtürk (2014), we note the following aspects: a multitude of papers focuses on *technical aspects* (these studies describe in detail the typology, structure, features and functionality of these two-dimensional barcodes and the algorithm used – like the works of Uitz and Harnisch (2012) and Rinkalkumar (2014)); some papers presents *exploratory researches* (these studies present the results of the surveys among users in order to capture the awareness and acceptance of the QR codes – like the researches conducted by Atkinson (2013) or by Kleine, Bayrak and Çilingirtürk (2014)); certain studies present scenarios related to *the use of codes, in various fields, in different contexts*, such as the application of QR codes in *trade* (especially, in *retail*) (Lawry and Choi, 2013), *marketing* (Dou and Li, 2008), *logistics* (Tarjan et al., 2014) or *education* (Lai et al., 2013). Although this paper subsidiary addresses technical issues regarding QR codes and also presents their applicability in retail, however, it falls into the category of those studies that focus on the *analysis and interpretation of the results of an exploratory research* that aims to determine to what extent QR codes are used and are considered useful, specifically in the buying process and in improving the shopping experience.

This article appears in the context of such an issue and aims both *to present the features and functionalities of the QR codes*, in the first part of the paper, and *to identify and to understand the behaviour, motivations and attitudes towards these codes*, by presenting the results of an *exploratory research* among Romanian users, in the second part of the article.

### **1. QR Code - structure and characteristics**

The *QR code* is a *matrix code* designed and developed primarily to be a symbol that is *easily scanned and interpreted* (Rouillard, 2008), consisting of a number of black and white squares, formally defined as *modules*, arranged in a grid pattern (Wara and Dugga, 2014), as can be seen in the figure no. 1. The code below contains the link to the official website of the International Organization for Standardization, where is presented the ISO standard regarding the QR code.



**Figure no. 1: Example of QR code**

Each module encodes data. The traditional codes (bar codes) can carry maximum 20 characters, while QR code has a much higher capacity because can encode *7 089 numeric data or 4 296 alphanumeric data* (Rinkalkumar, 2014). QR codes are categorized into *40 versions* depending on the number of modules contained by its two dimensions (version 1 contains 21x21 modules and version 40 contains 177x177 modules, each version having with four modules more than the previous). Currently, the version 6 of QR code (41x41 modules) is mainly used because it can be easily read by most mobile applications and can store enough data. The modules in QR code can be separated into two categories, namely: *function patterns* and *encoding regions*. The function patterns enable smartphones or cameras to recognize the QR code and the encoding region contains modules that represent data, error correction code words, and information on the version and format of the code (Lin, Luo and Chen, 2013).

Furthermore, QR code has *the ability to correct errors* due to deterioration and there are four levels of correction possible using the Reed-Solomon algorithm (non-binary cyclic error-correcting codes invented by Reed and Solomon (1960) that have described a systematic way of building codes that could detect and correct multiple random errors). According to this algorithm, QR codes contain validation data of the stored information to allow correct reading of the code although maximum 7%, 15%, 25% or 30% of the code image is missing, is damaged or contains incorrect information (Parikh, 2005). Considering precisely this feature of the QR code, the alteration of the code is possible even in terms of changing by styling, by inserting a logo or a visual symbol to make it more interesting and attractive (but considering the fact that changes are only allowed in the encoding region of the QR code symbol). Obviously, a higher level of error correction improves recovery of the code data, but to the detriment of the maximum number of characters that can be stored, given the fact that validation data are found also in the modules of the QR code. Therefore, a higher level of protection means less space for encoded data.

To benefit from this technology the user only needs to scan the QR code with the camera in his mobile phone, and the software will interpret and decipher the code. Depending on the type of data recognized and the nature of the application, alternative actions can follow the decoding stage, such as (Rouillard, 2008): a phone number can be automatically dialled, a short text message (SMS) can be sent, a web page corresponding to the decoded URL (Uniform Resource Locator used for localization and identification of resources on the Internet) can be displayed in a mobile browser, a person's contact details and indication of a geographical location can be viewed. Thereby, the two-dimensional barcodes serve as "*mobile tags*" and the above outlined process is related to the new concept of "*mobile tagging*", which refers to the possibilities to transfer data from a physical object to the mobile device (Ebner, 2008).

With the aid of the specific application, it's simply for a person to scan and decode QR-codes and then display, manipulate, or store the information on mobile devices (Liao and Lee, 2010), especially because many mobile phones with embedded camera are nowadays natively equipped with the QR code decoding software. Even so, there are many *freeware decoding applications* that are available on the Internet, such as ExecTag. Similarly, there are multiple application, such as Kaywa, that can be used for *free generating the QR code* (Choche and Arabnia, 2011).

## 2. The current state of knowledge concerning the applicability of QR codes in retail

Creating sources of competitive advantage in retailing is becoming increasingly difficult. One success factor is the innovation (Coca, Dobreă and Vasiliu, 2013). Innovation in retailing is manifested in the form of information technology applied for enhancing consumer experience in online shops and physical stores. In this era of technological change, there are significant challenges regarding the consumer behaviour, as Burghelea and Aceleanu (2014) mentioned. QR codes are among those emerging technologies that can *have a significant influence in the buying decision-making process* and *can contribute to improve the shopping experience* of the modern consumer. For that matter, in this manner are presented the QR codes in the literature, as will highlight forwards.

QR codes are described in literature as tools that are able to provide *adequate, accurate, and customizable information* and that allow the user to access the information *anywhere and anytime* (Shiang-Yen, Foo and Idrus, 2011). Especially QR codes applied on product packaging or labels or those that can be found in the commercial spaces (on shelves, showcase, posters etc.) are considered particularly effective in providing timely products and brands information given their ability to reach consumers when and where they are ready to buy with *relevant, targeted and interactive information* (Barnes, 2002; Unni and Harmon, 2007; Atkinson, 2013). By scanning these mobile tags applied on the label or packaging of the product, the user may be directed to:

- *detailed information about product* (for example, product specifications, manufacturing method or tutorials on how to install or how to use the product, video presentation of the product etc.);
- *online shop* where the product can be found (although, being in the physical store, in front of the product or already in possession of the product, this direction is no longer of interest or relevance for generating a purchase, however, the user may be directed to the comments/reviews page (in order to view the opinions of those who have already purchased the product or to post its own comment or rating of the product), to the recommendations of

the products that may be associated in consumption and can be purchased from the same online shop or to the section of the website that can allow subscription to the newsletter etc.);

- *social media pages* (social networks, online communities, user-generated content (UGC) sites etc.) of the manufacturer/distributor (to increase interactivity brand-customer);
- *coupons or vouchers* that can be obtained by those who already purchase the product;
- information about *events* related to manufacturer or distributor of the product.

In the same manner, QR codes located within the store (in the showcase, on billboards, shelves, flyers and brochures found in the shop or offered to the ones who bought from the store) can direct users to *coupons/vouchers*, information about the *sweepstakes, contests, events, mobile applications* that can be online downloaded, *contacts* and *other indications regarding the geographical location* of the stores from the same commercial chain etc. In this way, the users can obtain information that would facilitate the choice of the products, but also can improve their shopping experience.

If the seller aims that shoppers to use mobile technology in his physical store, should offer *free WiFi access*. Beyond the fact that the seller has to design *useful QR codes* to place in the physical store (not just links to the homepage of the online store - because the customer is already in the store, so there is no need to look at products online, this option being viable when the link is contained in a code applied on outdoor billboards, on the shop window, on leaflets, brochures, or catalogs of the trader - but to incorporate information about products, promotional campaigns, contests, events, mobile applications etc.), the seller has to place the QR code in an area that is *easy for the customer to scan* and has to make sure that *employees know about the QR codes* for helping the customers to use them. In this manner, the use of QR codes in store can determine *quickly and efficiently shopping*, as indicated by Wara and Dugga (2014).

### **3. Research methodology**

This research was based on a *standard methodology* that is applied in the *questionnaire based surveys*.

The *aim* of the research was to identify the Romanian consumers' attitudes towards usage of QR codes to access more information or to buy a product or a service.

More specifically, the *objectives* of this study are to:

- highlight the level of knowledge about QR codes among Romanian;
- determine the degree of QR codes usage and the reasons for scanning QR codes, and to identify the main barriers to adoption of QR codes;
- identify the perception of the interviewees regarding the characteristics of QR codes;
- evaluate the perception of the respondents about the useful content that could encourage adoption of QR codes.

The following *hypotheses* were formulated:

- H1: the majority of consumers are knowledgeable of QR codes;
- H2: the main reason for their use is related to access additional information about products;
- H3: the degree and intention of usage of QR codes are different according to the age of respondents;
- H4: the respondents consider that QR codes usage improves the shopping experience.

The *collectivity* that we studied consisted of the people living in Bucharest. The method of data collection was the use of a self-administered questionnaire. It was posted on web-site QuestionPro and was distributed as a link by e-mail to personal contacts and by using social networking sites LinkedIn and Facebook. The opening section of the questionnaire briefly explains the QR code technology (and include a QR code) to ensure a common frame of reference to all potential respondents.

The *questionnaire* was developed using closed questions with single or multiple choice answers, some of them with an 'Other: Please Specify' option. We also used questions with response options with five-point Likert scale (with 1 being 'strongly disagree' and 5 being 'strongly agree'). The first part of the questionnaire includes questions about awareness, usage, reasons and obstacles and intention to use QR codes. The second part measures the respondents' opinions related to the features of QR codes and to the type of content that leads to scanning QR codes. At the end of the questionnaire there are identification questions related to sex, age, education level and social category.

The *sample* used in the survey was 365 persons. Overall statistics provides by QuestionPro shows that the questionnaire was viewed by 607 persons, started by 433 and completed by 365. Completion rate was 84.3% and 74% of responses were collected from desktop/laptop, 23% from smartphone and 3% from tablets. Given the limited sample size, this online questionnaire-based study is an *exploratory research*.

The *data collection* occurred between 17 November 2014 and 8 December 2014.

IBM SPSS Statistics Version 22 *analysis software* was used in the study for descriptive statistics such frequencies and crosstabs, and for setting frequencies at questions with multiple answers. The same software was used for measuring the degree of association between variables by using Chi-Square test and for calculating the Pearson correlation coefficient.

#### 4. Results and discussions

The detailed demographics of the respondents show that 42.7% of the sample was male. Ages ranged from 18 to over 64 years, with the majority (57.5%) falling into the age range 18–34. The sample has a high level of education, with 84.4% being high school graduates, university students or university graduates. Regarding to the major social category, 49.6% of interviewees were employees, 37.5% pupil/students, 5.2% employers, 4.1% self-employees, 1.9% retired, 1.1% housewives and 0.5% unemployed.

In this study, 95% of respondents have a smartphone or a tablet with photo camera and the most common operating system of these devices is Android (64.1%) followed by iOS (18.9%) and Windows Phone (4.9%). Also, before completing the questionnaire survey, 64.7% of respondents knowing what QR codes are and 40.8% having scanned them. In addition, the proportion of respondents that have a QR reader installed in their mobile devices or intend to install one is 69.6%. These results confirm the hypothesis H1 that most consumers are aware of QR codes.

Table no. 1 shows that most QR codes were seen on *product packaging* (17.5% of responses), followed by *outdoor billboard* (11.8%), *leaflets/brochures* (11.3%), *newspapers/magazines* (10.7%) and *public transportation* (10.6%). Only 2% of respondents said they never seen a QR code.

**Table no. 1: Places where respondents have seen QR codes**

Where have you seen QR codes?	Responses		Percentage of Cases
	Number	Percentage	
On product packaging	212	17.5%	58.1%
In newspapers/magazines	130	10.7%	35.6%
On coupons/vouchers	88	7.3%	24.1%
On tickets/invitations	101	8.3%	27.7%
In posters/leaflets/brochures	137	11.3%	37.5%
On business card	29	2.4%	7.9%
In web pages	119	9.8%	32.6%
On TV	102	8.4%	27.9%
On outdoor posters	143	11.8%	39.2%
In public transportation	128	10.6%	35.1%
I never seen a QR code	24	2.0%	6.6%
Total	1213	100.0%	332.3%

Although 2% of the respondents haven't noticed such a QR code until completing the questionnaire (although perhaps they heard about it or knew its meaning), the respondents were able to see and understand better what is and for what scope such a code is used by reading the introductory section of the questionnaire, which provided such explanations and an example of QR code.

149 is the number of those that scanned QR codes, which represents 40.8 % of the respondents. Most of them were male (52.3%) and persons with age between 18-24 years (43%). The places where these respondents have scanned QR codes was at *home* (24.5% of responses), *in shops* (22%) and *on the street* (19.3%), as can be seen in the table no. 2. Places mentioned as responses at the variant "in other places" were: subway station, airport, university, bank, friend's home and at the hotel.

**Table no. 2: Places where respondents have scanned QR codes**

Where have you scanned QR codes?	Responses		Percent of Cases
	Number	Percentage	
At home	79	24.5%	53.0%
In a shop	71	22.0%	47.7%
In a library	9	2.8%	6.0%
At the cinema	21	6.5%	14.1%
At the museum	8	2.5%	5.4%
At the restaurant	35	10.9%	23.5%
At work	30	9.3%	20.1%
On the street	62	19.3%	41.6%
In other places	7	2.2%	4.7%
Total	322	100.0%	216.1%

The same number of respondents who have scanned QR codes mentioned the following reasons for doing that: *to receive more information about a product* (70.5% of cases), *to buy a product* (32.9%), *to access contact information* (24.2%) (see table no. 3). Reasons mentioned as responses at the variant "others" were: curiosity, download a picture, access video, and access online games. The main reason indicated for scanning QR codes was to receive additional information about products, confirming the hypothesis H2.



It is noteworthy that amples researches (ComScore, 2012) regarding the use of QR codes in the United States, but also in European countries such as France, Germany, Italy, Spain and United Kingdom, showed results similar to those recorded by our limited study, indicating that users are mainly young people, which have observed such codes especially on product labels and packaging, they have scanned codes at home or in stores, and they have indicated the use of codes for accessing information about products which interest them and for online purchasing.

**Table no. 3: Reasons for scanning QR codes**

Why did you scan QR codes?	Responses		Percentage of Cases
	Number	Percentage	
To buy a product	49	15.9%	32.9%
To receive more information about a product	105	34.1%	70.5%
To get a coupon, discount or deal	29	9.4%	19.5%
Enter a sweepstakes	19	6.2%	12.8%
Sign up to a newsletter	11	3.6%	7.4%
Access contact information	36	11.7%	24.2%
Access location map	34	11.0%	22.8%
Interact in social networks	16	5.2%	10.7%
Other	9	2.9%	6.0%
<b>Total</b>	<b>308</b>	<b>100.0%</b>	<b>206.7%</b>

216 people in the sample who did not scan QR codes mentioned the following reasons (see table no. 4): *did not find QR codes* for the products/services which interested them (45.4% of cases), *did not have Internet access* (38%) and they consider *there are simpler ways* to access the same information contained by QR codes (29.6%). Responses that were invoked as "other reasons" were: I didn't know about the existence of QR codes, I didn't know about any benefits to scanning QR codes, or I didn't know how to scan a QR code.

**Table no. 4: Reasons for not scanning QR codes**

Why you have not scanned QR codes?	Responses		Percentage of Cases
	Number	Percentage	
My phone is not able to read QR codes	54	15.8%	25.0%
Positioning of QR codes hinder their access and scanning	37	10.8%	17.1%
When I wanted to scan a QR code I didn't have Internet access	82	24.0%	38.0%
I didn't find QR codes for products/ services that interest me	98	28.7%	45.4%
There are simpler ways to access information contained by QR codes	64	18.7%	29.6%
Others	7	2.0%	3.2%
<b>Total</b>	<b>342</b>	<b>100.0%</b>	<b>158.3%</b>

279 persons from 365 of respondents (namely 60.7%) were interested in using a QR code, either again or for the first time (in the case of those who have never scanned). Among them there was 58.4% female and most were represented by young people (37.3% young persons aged between 18 and 24 years and 18.6% under the age of 18 years).

We specify that between the respondents' interest in scanning QR codes and their age is an average association (Pearson Chi-Square values calculated is 34.187 with 6 degree of freedom) (see table no. 5), which confirms the hypothesis H3.

**Table no. 5: Chi-Square Test**

Chi Square Test			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.187	6	.000
Likelihood Ratio	30.999	6	.000
Linear-by-Linear Association	.518	1	.472
N of Valid Cases	365		
Symmetric Measures			
		Value	Approx. Sig.
Nominal by Nominal	Phi	.306	.000
	Cramer's V	.306	.000
	Contingency Coefficient	.293	.000
N of Valid Cases		365	

The 279 respondents who were interested in scanning QR codes mentioned the following reasons: *to receive more information about a product* (in 75.3% of cases), *to buy a product* (52.0%) and *to obtain coupons and discounts* (50.2%) (see table no. 6).

**Table no. 6: Why respondents would be interested to scan QR codes**

Why would you be interested in using QR codes?	Responses		Percentage of Cases
	Number	Percentage	
To buy a product	145	16.6%	52.0%
To receive more information about a product	210	24.0%	75.3%
To get a coupon, discount or deal	140	16.0%	50.2%
Enter a sweepstakes	98	11.2%	35.1%
Sign up to a newsletter	37	4.2%	13.3%
Access contact information	93	10.6%	33.3%
Access location map	113	12.9%	40.5%
Interact in social networks	37	4.2%	13.3%
Other	2	0.2%	0.7%
<b>Total</b>	875	100.0%	313.6%

With respect to respondents' opinions about QR codes features, the average rating value for all statements is above 3.5, except the one relating to the influence on individual purchasing process (see table no. 7). It should be noted that, despite this result, is obviously that easier and quicker access to information allowed by QR codes *facilitates searching and finding the information needed in the buying decision-making process*. The main benefit perceived was that QR codes are *easy to scan*, 213 of the 365 respondents – meaning 58.4 % of respondents - agreed or strongly agreed with this statement). Also, most of the respondents agreed that QR codes *save consumers time* (208 of respondents agreed or strongly agreed with this statement), *are reachable by their position* (202), *increase brand-client interactivity* (189), and *enhance the shopping experience* (174).

Nevertheless, must take into account that all these advantages (the accessibility and ease of use of such instruments, such as QR codes - which make possible the fusion of online and offline channels - the interactivity and time saved through using QR codes) are in fact a contribution to a better shopping experience.

**Table no. 7: Scores of the respondents' opinions about QR codes features**

	<b>Strongly disagree (1)</b>	<b>Disagree</b>	<b>Neither agree nor disagree</b>	<b>Agree</b>	<b>Strongly agree (5)</b>	<b>Mean</b>
QR codes are reachable	5	22	136	156	46	3.59
QR codes are easy to scan with a mobile phone	4	27	121	159	54	3.64
QR codes enhance the shopping experience	6	27	158	135	39	3.48
QR codes influence the shopping process	24	82	153	91	15	2.98
QR codes increase brand-client interactivity	8	41	127	155	34	3.46
QR codes save consumers time	9	39	109	156	52	3.56

A direct and strong correlation ( $r=0.552$  at a significance level of 1%) occurs between those who believe that QR codes are reachable/accessible (by their position) and those who believe that QR codes are easy to scan with a mobile phone (see table no. 8).

**Table no. 8: Correlation between respondents' opinions about QR codes features (accessibility and the ease of use)**

		<b>QR codes are easy to scan with a mobile phone</b>
<b>QR codes are reachable (by their position)</b>	Pearson Correlation	.552**
	Sig. (2-tailed)	.000
	N	365
	Sig. (2-tailed)	
	N	365

Also, there is a direct strong correlation ( $r=0.582$  at a significance level of 1%) between those who believe that QR code enhance the shopping experience and those who believe that QR codes save consumers time (see table no. 9).

**Table no. 9: Correlation between respondents' opinions about QR codes features (improving shopping experience and saving time)**

		<b>QR codes save consumers time</b>
<b>QR codes enhance the shopping experience</b>	Pearson Correlation	.582**
	Sig. (2-tailed)	.000
	N	365
	Sig. (2-tailed)	
	N	365

The following table summarises responses to six questions regarding to the content type that could encourage adoption of QR codes (see table no. 10). It illustrates that 290 of the 365 respondents (79.4% of respondents) agreed or strongly agree that QR codes are useful if provide *additional information about product* and they would scan such codes and 271 respondents either agreed or strongly agree that they would scan a QR code if it links to *tutorials* showing how to install or use the product. In addition, 267 respondents either agree or strongly agree that would scan a QR code if it links to the *online store* where they can buy the product.

**Table no. 10: Scores of respondents' opinions about content type that could encourage adoption of QR codes**

<b>I would scan a QR code if it links to</b>	<b>Strongly disagree (1)</b>	<b>Disagree</b>	<b>Neither agree nor disagree</b>	<b>Agree</b>	<b>Strongly agree (5)</b>	<b>Mean</b>
additional information about product	5	13	57	175	115	4.05
tutorials showing how to install/ use the product	5	21	68	163	108	3.95
promotions about product	14	33	73	167	78	3.72
reviews of the product	7	35	87	169	67	3.70
website of the manufacturer	11	56	119	142	37	3.38
online store where I can buy the product	3	22	73	185	82	3.88

Between opinions of respondents that would scan QR codes if it provides additional information about product and opinion of those that would scan a QR code if it links to tutorials showing how to install/use the product there is a direct strong correlation ( $r=0.573$  at a significance level of 1%) (see table no. 11).

**Table no. 11: Correlation between respondents' opinions about QR codes content (additional information about product and tutorials)**

		<b>I would scan a QR code if it links to tutorials showing how to install/use the product</b>
<b>I would scan a QR code if it links to additional information about product</b>	Pearson Correlation	.573**
	Sig. (2-tailed)	.000
	N	365

Also, such a correlation appears between opinion of those that would scan a QR code if it links to the online store where I can buy the product and opinion of those that would scan a QR code if it links to reviews of the product ( $r=0.539$  at a significance level of 1%) (see table no. 12).

**Table no. 12: Correlation between respondents’ opinions about QR codes content (online shopping and reviews about product)**

		<b>I would scan a QR code if it links to reviews of the product</b>
<b>I would scan a QR code if it links to the online store where I can buy the product</b>	Pearson Correlation	.539**
	Sig. (2-tailed)	.000
	N	365

Given the above results, we conclude that the use QR codes improve the shopping experience, according to the respondents, confirming hypothesis H4.

Given the results of this research, when applying such mobile labels on product packaging, on promotional materials or within the store, Romanian retailers should consider the fact that QR codes that allow accessing additional information about products/services, buying online products/services, obtaining coupons/vouchers or finding contact details about organizations, this kind of codes present the greatest interest for Romanian users. Therefore, these codes should direct users to *information about products/services, coupons and vouchers, sweepstakes and contests, corporate web sites and online shops*. Also, many respondents mentioned they did not have Internet access when they wanted to scan these codes, but if the seller aims the use of mobile technology in his physical store, should offer free Wi-Fi access.

**Conclusions**

Any new technology needs to be perceived as being useful in order for it to be accepted and assimilated into people’s daily routines (Shin, Jung and Chang, 2012). For this reason, this study aimed to present the applicability and usefulness perceived by the users of this new technology, namely QR code.

By knowing and understanding how people act and react to QR codes, industries like retail and marketing could better design and adopt codes that are more precisely targeted and tailored to customer preferences, and more useful to customers in the buying process. The key to successful adoption of QR code is to understand why people might use this technology and the grounds for refusal or ignorance, and these motivations and attitudes identified in this research, indicating that most of the surveyed consumers were knowledgeable of QR codes and many of the respondents have scanned QR codes. The main reason for scanning QR codes (most of them being observed on products packaging and scanned in the store or at home) was to access information about products or services, but we found that consumers are also use QR codes to buy products, to access contact information or to get discount vouchers and coupons. We also found that the degree of use and the intention to use QR codes in the future vary according to the age of respondents, because most users are young (aged 18 to 24 years) and the intention to use QR codes in the future is also more pronounced among young people. But the most important aspect is that consumers are positive about the characteristics of the QR codes and understand the role played by codes in the individual shopping process and in improving shopping experience for users.

Taking into account the data was obtained by using a web-based survey among the personal contacts of authors and the main limitation of the research is the non-representativeness of the sample, we consider that future research developed among large survey sample, with

more diverse backgrounds, could provide a better understanding of consumer attitude regarding the usage of QR codes.

Although QR codes can only be used by owners of mobile devices, the sheer number of smartphone users in Romania provides businesses with a demanding clientele in terms of mobile content and willing to purchase products and services while on the move, the possibility to exploit the potential of these technologies to enrich the shopping experience and offer the customer real value through informing, involving and rewarding. Given the interest of the Romanian mobile users, more and more firms will become interested in applying QR codes on their products or on their promotional materials and in employing codes in their marketing campaigns. The potential for further adoption of QR codes is enormous and businesses that act now will get ahead of the emerging QR code trend for a competitive advantage and better customer experiences.

### References

- 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), pp.387–393.
- Barnes, S.J., 2002. Wireless digital advertising: nature and implications. *International Journal of Advertising*, 21(3), pp.399-420.
- Choche, A. and Arabnia, H., 2011. A Methodology to Conceal QR Codes for Security Applications. In: H. Arabnia and R. Hashemi, eds. 2011, *Proceedings of the 10<sup>th</sup> International Conference on Information and Knowledge Engineering (IKE'11)*. Las Vegas Nevada, USA, 18-21 July 2011. Las Vegas: CSREA Press. pp.151-160.
- ComScore, 2012. Overview of mobile commerce and QR code usage across European markets. [online] ComScore MobiLens service. Available at: <<http://www.comscore.com/Insights/Press-Releases/2012/9/QR-Code-Usage-Among-European-Smartphone-Owners-Doubles-Over-Past-Year>> [Accessed 28 December 2014].
- Dou, X. and Li, H., 2008. Creative use of QR Codes in consumer communication. *International Journal of Mobile Marketing*, 3(2), pp.61-67.
- Ebner, M., 2008. QR Code - the Business Card of Tomorrow?. In: A. Auinger, ed. 2008, *Proceedings of the FH Science Day*. Linz, Germany, 6th November 2008. Aachen: Shaker-Verlag. pp.431-435.
- International Organization for Standardization and International Electrotechnical Commission, 2006. ISO/IEC 18004:2006 - Information technology - Automatic identification and data capture techniques - QR Code 2005 bar code symbology specification. [online] ISO/IEC JTC 1/SC 3. Available at: <<https://www.iso.org/obp/ui/#iso:std:iso-iec:18004:ed-2:v1:en>> [Accessed 14 December 2014].
- Kan, T.W., Teng, C.H. and Chen, M.Y., 2011. QR Code based Augmented Reality Applications. In: B. Furht, ed. 2011, *Handbook of Augmented Reality*. New York: Springer. pp.339-355.
- Kleine, M., Bayrak, E.S. și Çilingirtürk, A.M., 2014. Impacts of QR codes on buying decision process of Turkish consumers. [online] *International Journal of Technology Marketing* (accepted for publication in December 2014). Available at:

- <<http://www.inderscience.com/info/ingeneral/forthcoming.php?jcode=ijtmkt>>  
[Accessed 14 December 2014].
- Lai, H.C, Chang, C.Y., Li, W.S., Fan, Y.L. and Wu, Y.T., 2013. The implementation of mobile learning in outdoor education: Application of QR codes. *British Journal of Educational Technology*, 44(2), pp.57-62.
- Lawry, C. A. and Choi, L., 2013. The Omnichannel Luxury Retail Experience: Building Mobile Trust and Technology Acceptance of QR Codes. *Marketing ZFP – Journal of Research and Management*, 35(2), pp.144-152.
- Liao, K.C. and Lee, W.H., 2010. A Novel User Authentication Scheme Based on QR-Code. *Journal of Networks*, 5(8), pp.937-941.
- Lin, Y.S., Luo, S.J. and Chen, B.Y., 2013. Artistic QR Code Embellishment. *Computer Graphics Forum*, 32(7), pp.137-146.
- Parikh, T.S., 2005. Using Mobile Phones for Secure, Distributed Document Processing in the Developing World. *IEEE Pervasive Computing*, 4(2), pp.74-81.
- Reed, I. S. and Solomon, G., 1960. Polynomial Codes Over Certain Finite Fields. *Journal of the Society for Industrial and Applied Mathematics*, 8(2), pp.300-304.
- Rinkalkumar, R., 2014. A Review on 1D & 2D Barcode with QR Code Basic Structure and Characteristics. *International Journal of Futuristic Trends in Engineering and Technology*, 4(1), pp.4-7.
- Rouillard, J., 2008. Contextual QR Codes. In: C. Paleologu, J. Noll, N. Antonopoulos, G. Jiang, D. Boyle and O. Dini, eds. 2008, *Proceedings of the Third International Multi-Conference on Computing in the Global Information Technology – ICCGI*. Athens, Greece, 27 July - 1 August 2008. Los Alamitos: Conference Publishing Services of IEEE Computer Society. pp.50-55.
- Shiang-Yen, T., Foo L.Y. and Idrus, R., 2011. Assessment of Public Perception toward Mobile Tagging System for Retrieving Information about Genetically Modified Food. *International Journal of Applied Mathematics and Informatics*, 5(1), pp.17-25.
- Shin, D.H., Jung, J. and Chang, B.H., 2012. The psychology behind QR codes: User experience perspective. *Computers in Human Behavior*, 28(4), pp.1417-1426.
- Tarjan, L., Šenk, I., Tegeltija, S., Stankovski, S. and Ostojic, G., 2014. A readability analysis for QR code application in a traceability system. *Computers and Electronics in Agriculture*, 109(9), pp.1-11.
- Uitz, I. and Harnisch, M., 2012. Der QR-Code – aktuelle Entwicklungen und Anwendungsbereiche. *Informatik Spektrum*, 35(5), pp.339-347.
- Unni, R. and Harmon, R., 2007. Perceived effectiveness of push vs. pull mobile location-based advertising. *Journal of Interactive Advertising*, 7(2), pp.48-71.
- Wara, A.A. and Dugga, S., 2014. Enhancing User Experience using Mobile QR-Code Application. *International Journal of Computer and Information Technology*, 3(6), pp.1310-1315.