
EFFECT OF QUICK RESPONSE CODE ON AGRI FOOD CONSUMPTION

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ABSTRACT

By adopting a quantitative research methodology this paper seeks to explore the characteristics and applicability of the QR codes in agri-food products. The research was conducted in Serbia with a sample 308 respondents. The statistical analysis methods employed were correlation and factor analysis using SPSS statistical program. The findings indicate that younger, more educated population in the proposed content of the QR code of honey; value the information on the certificate of honey quality, the chemical composition of honey and the influence of honey ingredients on the body with information on how to identify real honey, in relation to counterfeit, as the most useful to consumers. The results of this research have been further applied for the development of a QR code for a traditional food product, the Fruška Gora linden honey with a geographical indication.

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Introduction

Nowadays, the global flows of international trade in agri-food products undoubtedly indicate that the issue of availability and flow of food safety information has become one of the most important issues in both developed and developing countries. Numerous studies address the factors of demand (Ignjatijević et al., 2018), that is, consumer preferences (Ignjatijević et al., 2019; Vapa-Tankosić et al., 2018) and point to the fact that when buying a particular food product, the customer is influenced by different factors. Product quality is certainly not the only factor influencing the purchasing decision, so the customer evaluates previous experiences, makes comparisons with another product of the same brand or other brands, ie consciously or unconsciously collects product information (Đekić, 2006; Ilić, 2019). In modern conditions of agricultural production development, new technologies are gaining importance (Praća et al., 2017; Krunić, Matić, Đukić, 2019). Food safety is considered one of the most important issues in the production and processing of food products. Internationally, the balance of control shifts from classic health control to integrated safety systems with a focus on prevention and proactive action, emphasizing the importance of interventions in farmed areas (farm-to-table control), with a view to ensuring the best possible hygiene, food quality and safety (Kljajić et al., 2006). In many official documents, agriculture is defined as a very important industry for each Member State and for the European Union as a whole. Vapa-Tankosić and Stojsavljević (2014) point out that it is characteristic of the EU common agricultural policy that it seeks to compromise between strong centralization and a unified policy, while respecting both the needs of the local community and the historical heritage (Živković et al., 2019). In the first years of the Union's existence, much of the EU budget was earmarked for the implementation of the CAP. Today, this CAP budget is around € 55 billion a year, which is 40% of the total EU budget, approximately 0.5% of EU GDP.

In 2000, the European Commission laid down the general principles on which the Food Security Policy in Europe should rest (White Paper on food safety, [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM % 3A132041](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3A132041)). These principles include: a strategically integrated approach across the entire food production chain; clearly defining the roles of all actors in the chain (from producers, through farmers, through to European institutions, Member States and consumers); the principle of traceability (that each of the stages that a product has undergone can be reached at any time); a coherent, effective and dynamic policy; the principle of risk analysis (consisting of risk assessment, risk management and risk communication); the greater role of scientific institutions and applying the precautionary principle when managing risk. (Jovanović, Milenković, & Damnjanović, 2017)

Controlling food-related risks involves considering every step in the chain, from raw material to food consumption, as hazards can enter any point in the chain until the food reaches the consumer. Golan et al. (2004) state that businesses have three primary goals in developing, implementing, and maintaining a traceability system: to improve inventory management; to facilitate the monitoring of food safety and quality; and to

differentiate and sell foods with subtle quality attributes. The benefits can be reflected in cheaper distribution systems, reduced costs of withdrawal of goods and expansion of product sales. The Law on food safety of the Republic of Serbia (Official Gazette of the Republic of Serbia, no. 41/2009 and 17/2019) defines traceability as the ability to trace food, feed, animals used to produce food or ingredients intended for incorporation or is expected to will be incorporated into food through all stages of production, processing and distribution - "from field to table". The food safety begins, first, at the level of primary production and ends with the consumption of food by the final consumer. This system "determines the responsibility of all participants in the entire integrated food production, processing and distribution chain. At the same time, this system respects and encourages the production of traditional foods and foods of geographical origin" (Vesković Moračanin et al., 2014; Pantić, Jovanović, Issa, 2019).

The aim of the research is to look at consumers' attitudes towards QR code for honey and to create the QR code for honey of geographical indication in accordance with the research findings. The paper is structured as follows: after the introduction and a brief review of the literature, the authors have presented the methodology and research findings. In the end, suggestions on the conceptual design of the QR code are offered, explaining its possibilities. The concluding observations summarize the findings of the research. The results of the research will help to increase the recognition of honey, improve the process of honey promotion and enable professionals to better understand the current situation regarding the behavior of honey consumers, and possible solutions in implementing QR code on the market.

Literature review

Beekeeping is a very important sector in European agriculture. In the period 2017-2019, €216 million will be spent on national apiculture programs in 28 EU Member States, an increase of 9% over the 2014-2016 budget period with an increase in the number of incentive measures by from 6 to 8 (Vapa Tankosić et al, 2018). In recent years, the EU honey market has shown a steady increase in demand. In the traditional approach to selling honey products, consumers who buy honey products, trust the certification mark of the honey on the packaging. If such a honey product also contained a QR code, the consumer would have additional information and potentially control safety mechanism. QR code is a barcode or two-dimensional bar code created in 1994 by Denso-Wave. According to Tarjan et al. (2012) the use of QR code on product packaging simplifies the transmission of product information. The QR code was designed and developed primarily as a symbol (Wara and Dugga, 2014), and the version 6 of the QR code (41x41 modules) is mainly used because it is easy to read in most mobile applications and can store sufficient data (Rinkalkumar, 2014). Function patterns allow smartphones or cameras to recognize a QR code (Lin et al, 2013). The findings of Hossain et al (2018) demonstrate that sharing information via QR codes will influence customers to share information with other customers in the online community, while embedded QR codes can be very helpful for advertisers to share and influence customer satisfaction

and its purchase intention. According to Narang, Join and Roy (2012), the QR code currently provides additional information or additional incentive, engaging consumers to consider a product or service. They conclude that the QR code shortens the sales cycle and provides insight into consumer behavior, response rates, and demographics; monitoring online interaction etc. A QR code user can make purchases and payments almost simultaneously, which shortens the sales cycle and has a positive effect on advertising effectiveness (Meydanoglu, 2013). As Burghelea and Aceleanu (2014) point out, in this era of technological change, there are significant challenges in terms of consumer behavior. QR codes are among the new technologies that can have a significant impact on the purchasing decision-making process and can contribute to improving the shopping experience of the modern consumer.

The findings of Albastroiu and Felea (2015) have shown that in Romania the main reason for scanning QR codes was to access information on products or services (but were also using QR codes to buy products, to access contact information or to get discount vouchers and coupons). The degree of use and the intention to use QR codes in the future was varying according to the age of Romanian respondents, because most users were young (aged 18 to 24 years), while the most important aspect is that consumers were positive about the characteristics of the QR codes and understood the role played by codes in the individual shopping process and in improving shopping experience for users.(p.564).

Particularly those QR codes embedded on product packaging or labels, or those found in commercial spaces (shelves, cabinets, posters, etc.) are considered particularly effective in providing timely product information (Atkinson, 2013; Milojević, & Mihajlović, 2019). According to Atkinson (2013) scanning a QR code for a user can point to: detailed product information, an online store, social media pages, coupons or prize vouchers, information about events and events. In the same way, QR codes found in the store (in display cabinets, on billboards, shelves, flyers, and brochures on display at the store or offered to those who have purchased it at the store) may refer customers to coupons/vouchers, sweepstakes, contests, events, mobile applications that can be downloaded online, contacts and other clues regarding the geographical location of stores from the same retail chain, etc (Bakić, 2020). In this way, users can obtain information that will facilitate the choice of the product, but can also improve their shopping experience.

The QR code application is used also in the labeling of food products GMO content (Barham, 2002). The research by Hallman and Aquino (2005, p.220) has shown that their focus group respondents only read labels when they evaluate a new product or if they notice that something has changed on the label of a product they usually buy. The respondents read labels to primarily look to the ingredients panel and to the nutritional panel for fat content, sodium content, or calorie information and none of the participants even noticed the addition of a GM food (Chivu, 2019). Today, QR code benefits businesses and consumers, with unparalleled technological ability to quickly offer more content to consumers that focus on a certain company or brand

(Brokaw, 2012). The findings of Hugue et al. (2015) demonstrate the use of a QR code for product authentication purposes that may be applicable to small and large organic product manufacturers as the QR code enables product safety and consumer protection from the demand side, while protecting the organic agricultural producer from the supply side.

Materials and methods

The aim of the research is investigate the consumers' attitudes towards the QR code content for honey. The subject of this research is also the applied data analysis for the creation of the QR code for a traditional food product such as honey that is, for Fruška Gora honey with a geographical indication. The survey was conducted in the territory of Serbia in several places, from March 2019 to June 2019. Of the distributed 400 questionnaires, 308 were returned usable, with a response rate of 77%. The data was processed in the SPSS statistical package. The statistical analysis methods employed were correlation and factor analysis using SPSS statistical program.

Results and discussion

The sample consists of 308 respondents, of whom 59% are female and 41% male. Regarding the age structure, the largest number of respondents belongs to the younger generation, ages 18-24 (32.1%) and those aged 25-34 (37.2%). Given that QR code is a relatively new term and represents a form of innovation in the food industry, the research results are in line with the expectation that most users of QR code belong to younger age groups. In the sample, 72.4% of respondents have higher education, while 25.6% of respondents have completed secondary education.

Table 1. Respondents' ratings of QR code for honey

Question no.	Consumer attitudes	mean score
4	Chemical composition of honey, nutritional properties	4.03
3	Certificate of Honey Quality	3.97
5	Information on how to distinguish real honey versus counterfeit	3.81
15	Announcement of future sales events, promotions	3.45
20	A link that directly connects honey producers with consumers for getting more information, comments, suggestions	3.40
14	Current sales promotions	3.37
17	Information on geographical origin, characteristics of geographical origin	3.34
19	Doctor's advice on honey consumption, as well as tips for diabetics	3.25
18	Detailed information on honey producers, success, awards	2.95
6	Recipes for cakes and other honey desserts	2.84
1	Honey producers images	2.84
8	Use of honey in cosmetics	2.70
16	Video clip showing the process of honey production	2.69
9	A fun game for kids about honey and bees	2.68

Question no.	Consumer attitudes	mean score
2	Pictures of hives/apiaries	2.60
7	Consumptions statistics	2.42
10	Video about the life of bees	2.41
11	Video of the terrain where bees collect honey	2.31
13	Beekeepers Association Website	2.27
12	Literature on honey	2.08

Source: Authors' calculations

This percentage of respondents' participation showing a dominant share of the higher educational profile and it can be concluded that in this random sample the younger population of the higher educational profile is dominant, which again indicates a better knowledge of the younger and more educated population of technological changes and trends. The results of a survey on consumer useful information in a QR code on a food product - honey are shown below in the *Table 1*. Respondents rated the existence of the manufacturer's image as additional information in the QR code on honey with a mean score of 2.84. The results indicate that the honey producer's image is not particularly meaningful information that they want to obtain by scanning the QR code on the honey. A similar result is obtained when asked about the existence of a hive/apiary image as additional information in a QR code on honey, and the respondents rated with a mean score of 2.60. Therefore, respondents do not consider the image of hives/apiary as additional information via a QR code on honey. Honey Quality Certificate, has been rated with the mean score of 3.97 while the information on honey composition has been rated with the mean score of 4.04. Therefore, the respondents consider the certificate and information on the chemical composition of honey, that is, information on the effect of honey on the organism, to be desirable, as additional information in the QR code on honey. With the mean score of 3.81 the respondents rated the importance of information on how to identify true honey in relation to counterfeit. The respondents consider this information as important, as they did in the previous two answers: certificates and the chemical composition of honey/information on the effect of honey ingredients on the body, which also indicates that there is a connection with the respondents' view of the importance of food quality information. The respondents' attitude towards cakes and other recipes as additional information in the QR code on honey is rated with the mean score of 2.84, which indicates that respondents are quite indifferent in this regard. The respondents rated information on preferences in honey consumption with the mean score of 2.42, and use of honey in cosmetics with the mean score of 2.70. Thus, respondents indicated that information about preferences in honey consumption and honey use in cosmetics were not among the priorities when it came to additional information on honey provided by the QR code.

The respondents rated the existence of a fun game in the QR code with the mean score of 2.68, which is in line with the demographic indicators of the respondents. As the sample is dominated by the younger population, it can be said that this result is expected due to

the fact that younger populations have not yet formed their families, that is, the majority are respondents who do not have children. The respondents were not interested to watch a video about the life of the bees (2.41) and the video of the terrain where bees collect honey (2.31) as additional information in the QR code on the honey. Respondents rated with the mean score of 2.08 the importance of literature, books on honey, the honey production process with the mean score of 2.69, and the information on the beekeepers association website with the mean score of 2.27. Nevertheless, the respondents rated the existence of information on current actions/promotion with the mean score of 3.37. Compared to the previous answers offered, there is a growing consumer interest, that is, the respondents rated the current actions/promotions with higher scores as they would like to have additional information on promotions. Respondents in large numbers believe that announcement of actions/novelties/promotion is a desirable piece of additional information on honey. Information on geographical origin and characteristics of geographical origin, with appropriate additional information, were considered by the respondents important and rated with the mean score of 3.34 and the information on the producers' achievements and awards information was rated with the mean score of 2.95. Finally, respondents rated doctors' advice on honey consumption and advice for diabetics as additional information on honey via QR code with the mean score of 3.25, and we can say that doctor advice on consumption of honey, as well as advice for diabetics, recorded positive views by the respondents. When asked about the importance of having a link to a manufacturer, the respondents rated a link linking producers to consumers for more information about honey via QR code to get additional information, comment, suggestions and praise with the mean score of 3.40.

In the continuation of the research, a correlation analysis was carried out in order to establish the correlation of particular QR code information on FLM honey. The authors used the Correlation Strength Scale (Cohen, 1988, pp. 79–81): small $r=0.10$ to 0.29 mean $r=0.30$ to 0.49 and large $r=0.50$ to 1.0 . Below we present correlations that are large and statistically significant. The results of the study show that a large (strong) correlation exists between the bee image and the producer image ($r=0.577^{**}$); Nutritional characteristics of honey and honey quality certificates ($r=0.659^{*}$); Information on the quality of honey, that is, on the originality and existence of certificates and nutritional properties $r=0.632^{**}$ and 0.568^{**}); Information on honey consumption tendencies is in direct strong correlation with recipes for honey use and the use of honey for cosmetic purposes (0.506^{**} , 0.572^{**}); The honey consumption tendencies is positively correlated with the image of the apiary (0.504^{**}). Videos about the life of bees, as well as a video of the terrain where bees collect honey, are correlated with honey tendencies consumption. The video on honey production is correlated with the use of honey in cosmetics (0.564^{**}), games for children ($r=0.534^{**}$), videos about the life of bees ($r=0.535^{**}$) and a video of terrain where bees collect honey ($r=0.501^{**}$). The manufacturer's website is strongly correlated to the video on honey production ($r=0.507^{**}$). Announcement of actions, novelty and promotion is correlated with current sales ($r=0.807^{**}$). Information on the success of beekeepers, rewards are

strongly correlated with information on the geographical origin of honey ($r = 0.556 *$). Novelties announcements and sales actions are strongly correlated with doctors' advice on the importance of honey ($r = 0.499 **$) and a video clip on honey production ($r = 0.552 **$). The strong correlation of the link of beekeepers with the ability to provide doctors advice on the benefits of using honey ($r = 0.515 **$) is very interesting.

Table 2. The final pattern matrix obtained in the factor analyses

Pattern Matrix ^a		
	Component	
	1	2
Video_clip_of_life_bees	,898	
List_literature_and_books_on_honey	,880	
Video_clip_of_the_pasture_bees_collect_honey	,875	
Beekeepers_Association_website	,783	
Child_game_honey	,750	
Tendencies_consumers_honey	,667	
Use_of_honey_in_cosmetics	,658	
Video_clip_of_production_honey	,608	
Recipes_about_use_in_nutrition_honey	,516	
Apiary_picture	,454	
Producer_image		
Nutritional_characteristics_honey		,855
Certificate_of_quality_honey		,837
Real_honey_information		,744
Announcement_new_action_promotion		,672
Current_Actions_and_Promotions		,671
Geographic_origin_honey_information		,566
Link_for_connections_to_producers		,472
Success_information_and_beekeepers_awards		,463
Pharmacy_medicine_tips		,457
Percentage_of_variation_Cumulative	39,476	13,046
Cumulative_Percentage	39,476	52,52
Initial_Eigenvalues	7,895	2,609
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.		
a. Rotation converged in 8 iterations.		

Source: Authors' calculations

In the proceeding part we started from the assumption that consumers' perceptions of QR code on honey do not differ significantly, so we performed a unified factor analysis. In order to examine the latent structure of the Questionnaire to measure respondents' perception of QR code, a factor analysis, principal component method (PCA) was applied. As the Kaiser-Meyer-Olkin measure of sample adequacy was satisfactorily

high (KMO= .880), Bartlett's test of sphericity was significant ($\chi^2=3599.64$, $p<.000$). Principal component analysis revealed the presence of four components with characteristic values over 1, explaining 39,476%, 13,046%, 7,228% and 5,439% of the variance. Two factors were retained based on Cattell's scree criteria. This two-component solution explained a total of 52.52%, with the contribution of the first component being 39.476% and the second component being 13.046%. For easier interpretation of these two components, oblimin rotations were performed and many large factor weights were obtained. There is a mean positive correlation between the two factors ($r = 0.392$). Taking into account the saturations shown in the matrix of the assemblage (Table 2), the obtained factors are grouped into 2 units: first factor - the visual identity of the beekeeper, bee pasture and honey; the second factor combines information on honey quality, beekeepers' competences and actuality in honey distribution and promotion.

In the final part of our research, the empirical results have been applied in the development of a QR code for a traditional food product, the Fruška Gora linden honey with a geographical indication. Since only a few food products on the Vojvodina market have a QR code, which are mainly products of high quality and tradition, Fruška Gora linden honey. In this way, consumers will be able to track the information on Fruška Gora linden honey through an application that is easily accessible on smartphones. This will allow the honey to be differentiated from other types of honey on the market and provide added value to consumers. The QR code has been created for Fruška Gora linden honey. When the QR code is scanned, a drop-down menu with 5 links opens. The site of the Beekeepers Association "Jovan Živanović" enables to obtain information on registered producers, pictures of beekeepers and pastures and other similar information. A brochure is another, very significant segment of code, which integrates information contained in another group of factors (obtained by previously mentioned factor analysis). Within this second group of factors is the information on current promotions and sales, which form the third segment of the QR code under the heading Manifestations. The fourth segment of the QR code refers to a video about producers of organic products in Vojvodina and products with geographical origin - Fruška Gora linden honey. The fifth link takes to the Facebook page where all the formal and informal information about the honey is located, with a possibility of establishing direct communication between beekeepers and consumers.

Figure 1. QR code for Fruška Gora linden honey



Conclusions

In the last decade, there have been major changes in online food safety monitoring tools and technologies. As a result, manufacturers are forced to develop innovative strategies for online communication channels to further secure their revenue, retain existing and attract new consumers. Such strategies can be implemented by tagging the product with a QR code. QR codes have been used in the markets of developed countries for a long time and are slowly becoming an integral part of the product in the markets of developing countries. Younger populations with higher educational status are more inclined to research novelties, more easily adapt to changes and follow trends, both technological and life-changing. Consequently, their habits and lifestyles are more easily adapted in regard to older populations, and they tend to change their habits and lifestyles as well as their diet. Today, young brand ambassadors are promoters of a particular lifestyle with a great influence on their friends, acquaintances and followers on high-speed social networks. This is why companies are focusing on social networks as a marketing tool for communication with consumers, but also for young people who promote the products of these same companies through social networks. Young, educated people pay attention to healthier lifestyles but also to learning and gathering additional information. On the other hand, they are adept at managing smartphones, various applications, and the QR code for them is an easy and interesting opportunity to gather additional information about a product, brand, company and the like.

The research results indicate that the respondents attach importance to the quality of the food products and that the information provided on the packaging is important to them. For this reason, the subject of research in this paper was the analysis of the application of a QR code for a traditional food product, Fruška Gora linden honey with a geographical indication. Evaluating which additional information on honey QR code the respondents consider the answers concerning the quality of honey, the chemical composition and the distinction of real honey with respect to counterfeit have proven to be most valuable to consumers. This confirms that young people are more focused on healthier lifestyles and gathering additional information about the products they consume. We can conclude that it is quite feasible to implement new information technology proposals and take advantage of these new opportunities in order to disseminate information on safe and nutritional products to the consumers. A credible and cost-effective production and marketing system can provide increased product safety and quality and thus can bring the product closer to consumers and offer them an enhanced quality system, production process controls, or added security. The information in the QR code can be crucial for consumers in deciding whether or not to buy a particular agri-food product.

Conflict of interests

The authors declare no conflict of interest.

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