

Do I know what I eat? The use of QR code in Food Packaging to Provide Traceability Information

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Abstract — *This research aimed to analyze the use of QR code in the packaging of agri-food products as a tool for communication and relationship between consumer and company, aiming to make the product and process traceable information available. In a specific way, the information considered relevant to the final consumer was identified under normal purchasing conditions. This research has an exploratory and descriptive character, and its data were collected with consumers in supermarkets located in two cities of Sao Paulo State: Marilia and Sao Carlos. The results showed that not all the information obtained in the tracking process is made available to final consumers and that the lack of knowledge about QR code is still considerable for consumers. In general, the consumers interviewed in Sao Carlos had higher income and higher education than those interviewed in Marilia, and these characteristics seemed to have resulted directly in the knowledge about the technology of the QR code, higher in Sao Carlos. The main contribution of this research is based on the survey of the information that the interviewed consumers consider important for the purchase decision of agri-food products, constituting an important reference so that the companies that currently work with traceability, be it industry or retail, can improve their labels, adding value to the marketed product. The study can be used as a starting point for other researches, testing new information and other products, making even possible comparisons.*

Keywords — *Packaging; Product information; QR Code; Food Traceability.*

I. INTRODUCTION

Food safety problems and the growing consumer interest in food traceability stand out in consumer relations.

Therefore, concern about food safety and possible health risks added to the need for transparent information has influenced food demand, increasing the importance of traceability of these products [1].

For [2], the detailed information that a traceability system provides can add value to food products, address legal security issues, improve consumer confidence and satisfaction, and make companies more competitive.

Considering that consumers are increasingly interested in practical information, it is believed that they are predisposed to use their smartphones to access information from the manufacturer/producer at the point of sale, assisting in decision making. In recent years, the number of people who have a smartphone with internet access has grown considerably. In 2018, Brazil already had more than 234.6 million wireless connections, 73% of which were through smartphones and 35% using 4G technology, which put the country first in Latin America among the countries with the highest number of smartphones connected to the Internet. Besides, between 2012 and 2016 the number of households with mobile connections grew 86%, reaching 9.3 million, indicating that 54% of households and 61% of Brazilians, over ten years old, are connected [3].

As mobile access technology progresses, company websites are increasingly being visited through mobile devices. However, according to [4], this growth is not accompanied by websites concerning browsing and mobile search, since mobile access to the web differs from current access by the format of the screens, content types and mode of interaction with the user.

According to [5], QR code technology has been increasingly used in packaging and print advertisements (magazines, newspapers, folders) and promotional

campaigns, although many consumers are still unaware of this new “Symbol” printed on the packaging.

According to [6], the QR code has gained great commercial popularity due to mobile technology. However, its use is less widespread in western countries than in Asian countries. In Brazil, it was from 2007 that some companies began to adopt the QR code in movie tickets, air tickets, magazines, and some food packaging. [7] pointed out that this technology has become popular as a marketing strategy, spreading the offer and the company or even directing the consumer’s choices, since the buying process involves several small decisions besides the search for information, which with the type of product and the degree of buyer involvement. Thus, [8] understood that companies need to consider this behavior, so that the use of QR code can make the purchasing environment more attractive, broaden the senses involved in the consumption experience and provide information product, brand or company.

A QR code is one of the most popular types of two-dimensional barcode and was created in 1994 by the Toyota-Denso Wave subsidiary, with the purpose of enabling the catalog of different parts in the automobile industry [9]. [10] described it as a bitmap image converted into information, which can range from a text (interactive), a URL address, a telephone number, a geo-referenced location to an email, contact, or SMS.

Other identification technologies such as traditional barcodes and radio frequency identification (RFID) can be integrated into traceability systems. [11] evaluated the use of barcode and RFID technologies in manual fruit harvesting to improve traceability. [12] explored the feasibility of adopting linear and 2D barcodes for the traceability of poultry products. More recently, [13] have instituted a wheat flour traceability system based on the 2D barcode and RFID technologies, spanning the entire supply chain, especially the processing steps.

However, [9] reported that companies still have not been able to figure out how to maximize the benefits of using QR code, which offers interactivity when scanning, allowing access to different content from mobile devices, increasing the potential of interactivity through clicks or by performing a specific task to receive a special offer, for example. With the use of this tool, designed for quick and easy access to content on smartphones, consumers may feel more connected to the brand.

One of the main purposes of this research is to associate the interest of consumers with fast information and content about the characteristics of food, to a technology that makes such information practical and straightforward. [14] noted that consumers recognize the importance of the information contained in the labels and are more interested in practical information, such as

methods of preparation, safety assurance, brand quality, and its products.

In this sense, traceability associated with the use of QR code may be the answer to safer foods, since it can provide a lot of information and transparency of the complex productive chains, thus guaranteeing the quality and safety of the products [15].

In view of these findings, and especially that there is little research focusing on the use of QR code, and consumer attitudes towards it, the general objective of this research was to analyze the use of QR code in packaging of agri-food products as a communication tool and relationship between company and consumer, aiming to provide additional product traceability information.

The article was divided into five topics, including this introduction. Next, we present the theoretical review of the topics covered in the research, including traceability, QR code technology, and its application as a marketing strategy, and packaging for food, including its age marketing function. Section 3 explains the methodology adopted in the research. The results are presented in section 4, divided into socioeconomic and demographic characteristics of the consumers, their previous contact with the QR code, the information of the product considered more critical by him and the respective analyzes. Finally, section 5 deals with the final considerations of the study, including its contributions, limitations, and future suggestions.

II. THEORETICAL REFERENCES

2.1. Food Packaging

Packaging is essential, as it performs critical functions such as protection, packaging, and storage, enables distribution logistics, allowing the product to arrive at its destination in the best possible way, preserving the quality attributes of the product. [16] reported that packaging is practically a symbol of the product, reaching in some cases, to be as important as its content.

In self-service outlets, such as food retailing, the attendant and salesperson figures are practically non-existent, with packaging being responsible for communicating to consumers the product and brand messages. Most of the time, the packaging is the only form of communication that the product has, since about 90% of the products on display, according to [17], do not have any communication and marketing support at the points of sale.

Packaging represents the element that positions the product to face competition, establishes consumer segments and enhances the image of the brand and the company. According to [18], it symbolizes the product and identifies the brand on the supermarket shelf, in the stores and the cabinets of the houses, making the difference between the various products belonging to the same category.

The distribution chains have driven the changes that have been occurring in the markets. Supermarkets prefer innovative packaging because they believe they influence sales and play a critical role in maintaining product status. This concern is because most purchase decisions occur at the point of sale. For these reasons, the size and dimensions of the package should be planned based on its shelf display and subsequent accommodation in consumer shopping bags. Also, the packaging should always be functional, comfortable to open, close, discard and allow the use of suitable portions, giving convenience to the consumer, a critical factor in the choice of product [19].

The appearance of the packaging affects the way in which the quality and value of the product are perceived. Labels are essential elements, as they act both on the functional aspects of packaging, communicating the product information, and on the aesthetic aspects, attracting the consumer and motivating him to purchase. In this sense, the use of clear and objective language on the label helps the consumer to make the right decision at the time of purchase.

Product labels should prioritize the mandatory information established by the Consumer Defense Code. The primary information relates to the name of the product (brand) and the company, expiry date, full address, and composition in the case of food. Non-mandatory information such as promotions, logo, and codes are also essential elements.

The National Agency for Sanitary Vigilance (ANVISA) defines a label as “any inscription, legend, and image or any descriptive or graphic material that is written, printed, stamped, engraved or pasted on the food packaging” [20]. Packaging-related regulations include packaging and materials that come into direct contact with food and are intended to contain them, from their manufacture to delivery to the consumer, to protect them from external agents, changes and contamination, as well as adulteration.

2.2. The use of QR code as a marketing strategy

The industry, in general, has been working to stamp the QR code on the packaging of the products, from which the consumer can access, instantaneously, gifts, services, and information hosted on the Internet [21].

For [22], there is little research available on the factors that affect consumers' response to QR codes, especially from the marketing point of view. According to [9], the QR code, originally designed to track parts in vehicle manufacturing, has been used in a much broader context, ranging from commercial tracking to entertainment, and marketing the labeling of the product. Many of these applications are intended for smartphone users who can receive text messages, add a vCard contact to the device, open a URL or compose an email or text message after reading the code.

[22] included other applications such as product images and coupons. The main benefit of this technology is the

ease of use since it is only necessary to scan the codes with the mobile device so that the consumer has access to the coded data. QR codes have been made available in different media, such as magazines, newspapers, posters, packaging, labels, and receipts, and play a key role in bridging the advertising media with promotional sites in cross-media strategy-average).

[23] called these mobile marketing strategies, which are characterized by the marketing actions developed with the help of the cellular telephone, generally used to leverage the construction of a satisfactory and lasting relationship between the companies and their clients.

Marketing communication using a QR code in the retail environment offers utilitarian and non-utilitarian benefits to consumers, such as business and convenience information or a more enjoyable shopping experience, respectively [24], and [25]. For [26], food labeling is a powerful tool for consumer education, and the information on the label can contribute to the decision to purchase the product.

In this sense, the concept of mobile tagging arises, which refers to the labels of products with expanded communication capacity, going beyond the presentation of traditional information, such as weight, validity, and constitution of the product, beyond the space-temporal and printed language. For [8], the use of mobile labels tends to become an essential component in shaping consumer opinion.

Considering that consumers, in general, have difficulty interpreting food labels accurately or objectively, there is a gap in the information that marks the purchase decision [5]. In this sense, a mobile tagging system can be the solution for these consumers to access accurate and adequate information through the QR code available on the product packaging. The QR code mind allows retrieving extra information stored in any database, which can also be customized accordingly with the preference and need of different groups of consumers, constituting a strategy of market segmentation and product positioning. Thus, information provided on the label of food and beverages can contribute to the decision to buy the consumer, because according to [27], this is facilitated using digital strategies in communication and marketing campaigns of companies, which has diversified with the integration of mobility and portability of access to the web, constituting new pillars of integrated communication.

2.3. The QR code and traceability in the food industry

The topic of food traceability has been more frequently verified in the economic literature, for example, [28] and [29], who discussed their effect on market failures in the food sectors. [30] estimated the consumer's willingness to pay for a tracking system, and [31] explored the relationship between traceability and food safety regarding the assignment of responsibility.

Traceability has become a frequent feature of international agrifood chains because of problems related to food safety and consumer demand, especially in developed countries, and is, therefore, increasingly valued by policymakers and food industry [1].

Resende Filho (2006) and Pouliot (2008), cited by [32], pointed out that the use of traceability is part of the strategies of coping with competition, providing differentiation of supply, contributing to the brand/company credibility and safeguarding origin of the products offered, to take account of consumers' interests in safe food.

For [2], the necessary traceability information provided in product labels is not adequate for purchasing decisions as some consumers look for more detailed information that is not available on the packaging label, such as the location of the farm or pesticides used. Thus, companies have adopted some strategies to solve this problem. [33], for example, proposed the use of QR code on the fish packaging label, combined with traceability, providing the consumer with access to additional information regarding different stages of the production chain that could be accessed by consumers, decision making and greatly facilitating the process of inspection and control within the production chain.

[34] proposed the use of intelligent packaging integrated with traceability systems, in order to create more effective communication channels. Barcodes and RFID tags enable electronic records and information sharing, especially when connected to external instruments that can quickly measure quality attributes and monitor food safety.

III. METHODOLOGY

The objective of the study and its scope make it possible to define the research as exploratory and descriptive. The exploratory research aims to provide the researcher with a greater familiarity with the problem under study, with the goal of making a complex problem more explicit or even constructing more appropriate hypotheses. According to [35], the exploratory research is conducted to enable an understanding of the problem faced by the researcher and is used when it is necessary to define the problem more precisely and to identify relevant courses of action or to obtain additional data before an approach can be developed. As the name suggests, exploratory research seeks to explore a problem or situation to provide criteria and understanding, using broad and versatile methods such as surveys of secondary sources, surveys of experience, selected case studies, and informal observation.

On the other hand, the structure of data collection was typical of a descriptive study. The descriptive research aims to know and interpret reality without interfering in it to modify it, seeking to discover and observe phenomena, to describe them, to classify them and to interpret them, establishing a relation between the variables [36].

The research had a qualitative approach because this methodological procedure houses several techniques that try to describe and translate the main question, promoting the understanding of the problem. The qualitative method is more directed to the understanding of the facts than in the measurement of phenomena [37]. Qualitative research is adequate in studies of complex subjects, allowing the researcher to obtain more detailed information and work in more depth the question to be studied. The most significant advantage of this type of research lies in the richness of the details obtained.

This research step used a structured form with closed questions applied to end consumers. The tests were carried out in supermarkets in two cities of Sao Paulo State - Marilia and Sao Carlos -, and the interviews were conducted by the researchers who, after the agreement of the retailers, approached the people in the place, inviting them to participate in the search. The total number of samples in the two retailers was 70 participants.

The researchers presented the application to the volunteers, read the QR codes, using a smartphone with the iOS system, belonging to the interviewer, to identify the interest of consumers in the information provided by a QR code printed on the label of products with labels modified for the search. Three product categories were selected: (i) FV (Fruits and Vegetables): papaya and banana silver; (ii) Meat: fillet steak and mature file steak; and (iii) Alcoholic beverages: wines.

After analyzing the information provided in an application specially developed for this research, respondents answered a set of 14 questions, which were weighted by a 5-point Likert scale (I strongly disagree, partially disagree, do not know how to comment, partially agree and I agree). [38] affirmed that the Likert-type scale presents more precise information on the opinion of the individual about each question presented to the respondent because it is a classification scale that allows indicating a degree of agreement or disagreement with each of the assertions presented.

The assertions addressed the interviewee's knowledge about the information available in the current labels, the quality of the information provided by the current labels, traceability information, purchase decision making from the use of the application and questions about the application used as a tool and facilitator information.

The data were analyzed utilizing descriptive statistics and the chi-square test, using the Cramer's V correlation coefficient to measure the intensity of the statistically significant association of the variables. In general, the intensity of association is only of interest if it is statistically significant, that is when the p-value (probability of significance) of said test is less than or equal to the level of significance α established, which in this case was 5%. Statistical software SPSS 22.0 was used for these analyzes.

The Cramer coefficient V is a measure of association between two variables measured on a particular scale and can be applied in situations where the information is distributed. In general, the intensity of association is only of interest if the association is statistically significant. Cramer's V ranges from 0 to 1, and when the variables are independent, V will be approximately equal to zero. A significant value of V indicates only a high degree of association and not how the variables are associated [39].

IV. RESULTS

Consumers were approached in two supermarkets, in Marilia and Sao Carlos. The two cities were chosen because they had similarities in the number of inhabitants (216,745 and 221,950, respectively), area (1,170,250 km² and 1,137,332 km², respectively), Human Development Index - HDI (0.788 and 0.805, respectively), number of operating companies (9,175 and 10,717, respectively), but they have different per capita GDP (R\$ 20,303.30 and R\$ 30,245.20, respectively), according to data from the 2010 Census [40]. Fig. 1 illustrates data collection at both supermarkets.



Fig. 1: Research conducted with consumers in supermarkets in Marilia-SP and Sao Carlos-SP.

The participants of the research were presented to a specific application for reading QR codes explicitly prepared for the research and received a brief explanation of their functionalities. They then answered some questions about the information available in the current labels of the

products, the quality of the information made available by the companies and the use of the said application for purchasing decision making. Fig. 2 shows some screens of this application, regarding the readings of the QR codes realized during the test with the consumers.



Fig. 2: QR code reading history screens, product and comparative information between searched products - Qinfo application

The main results of the research are presented below, starting with the profile of the consumers, where the socioeconomic and demographic characteristics are presented, and whether they knew the QR code at the time of the research. The primary information considered by consumers in purchasing decision making for four product categories: meat, alcoholic beverages, FVs and grocery, and bakery products are presented below. Finally, the analyzes of the correlation between the variables of the consumer profile and the information considered necessary in the purchase decision are presented.

In Sao Carlos, more women than men were interviewed, unlike Marilia. The predominant age among respondents in Sao Carlos was the age group between 25 and 34 years, followed by the age group between 35 and 44 years, while in Marilia the ages were between 16 and 34 years (54.3%). There was also a higher number of consumers aged 55 to 64 years in Sao Carlos (17.1%).

Table 1 presents the consumers' profile in Sao Carlos-SP and Marilia-SP.

Base	Sao Carlos		Marilia	
	Total		Total	
	35		35	
Genre	A.N.	%	A.N.	%
Female	21	60.0	16	45.7
Male	14	40.0	19	54.3
Education Level				
No instruction	0	0.0	0	0.0
Some grade school	0	0.0	3	8.6
Grade school	0	0.0	0	0.0
Some high school	0	0.0	5	14.3
High school	6	17.1	14	40.0
Some college	3	8.6	5	14.3
College	11	31.4	8	22.9
Postgraduate	15	42.9	0	0.0
Age				
16-24 years	0	0.0	9	25.7

25-34 years	13	37.1	10	28.6
35-44 years	10	28.6	7	20.0
45-54 years	5	14.3	4	11.4
55-64 years	6	17.1	3	8.6
Over 65 years	1	2.9	2	5.7
Marital status				
Single	11	31.4	12	34.3
Married	20	57.1	20	57.1
Divorced	2	5.7	3	8.6
Widower	1	2.9	0	0.0
Stable union	1	2.9	0	0.0
Family income				
Less than 1 M.W.	0	0.0	0	0.0
1 - 3 M.W.	8	22.9	9	25.7
3 - 5 M.W.	7	20.0	15	42.9
5 - 7 M.W.	5	14.3	8	22.9
7 - 10 M.W.	4	11.4	0	0.0
More than 10 M.W.	11	31.4	3	8.6
Did you already know QR code?				
Yes	25	71.4	16	45.7
Not	10	28.6	19	54.3

Source: Elaborated by authors from data research

Marilia's consumers were mostly full-time graduates (40.0%), followed by higher education (22.9%), while in Sao Carlos, the principal level of education was postgraduate (42.9%), followed by complete higher education (31.4%). This difference can be justified by the location of the two establishments (in Sao Carlos the

establishment is located in a more central area, while in Marilia, the retail is located in a more peripheral region). Moreover, San Carlos has two public universities and is recognized nationally as the city with the highest number of doctors per capita [41]

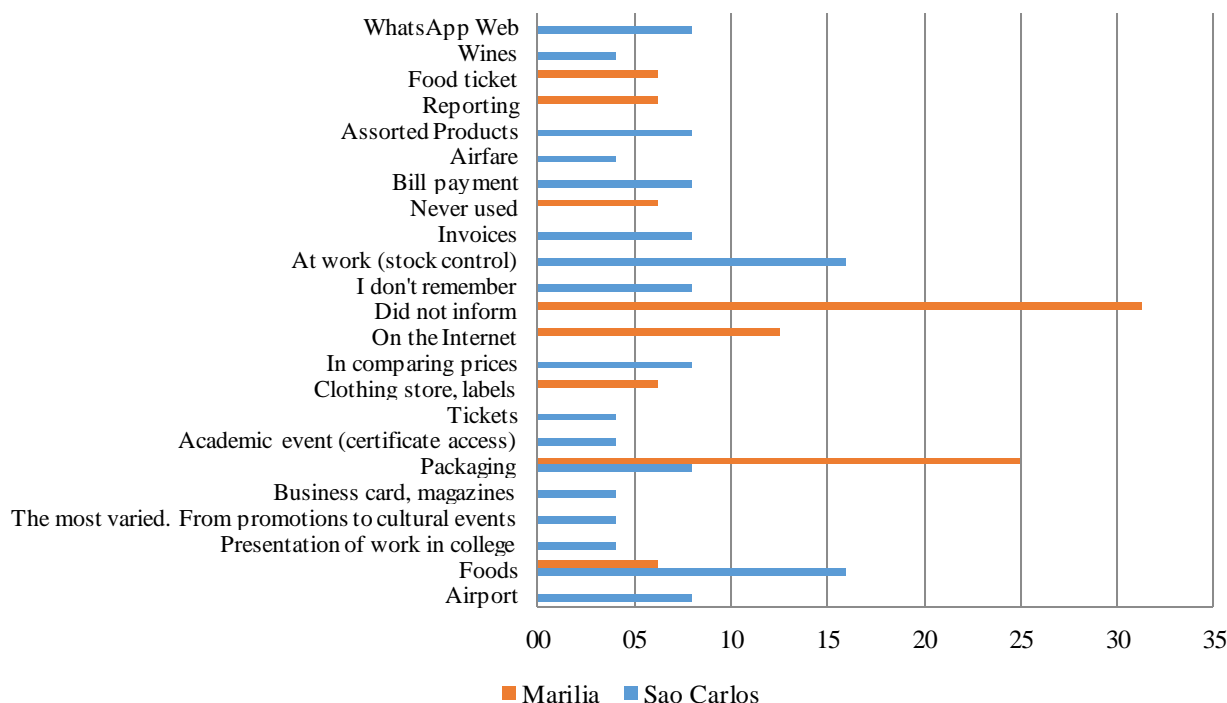


Fig. 3: Situations in which the interviewee knew/used the QR code (%)

While in Sao Carlos, the average family income was concentrated in the range of more than seven minimum

wages (42.8%), in Marilia, the effective income range was three to five minimum wages (42.9%). This

characteristic of the profile suggests that the target audience of the Sao Carlos supermarket has a greater focus in the A-B-C classes, while the Marilia one focuses more on the C-D-E classes, later confirmed by the assortment of products and prices practiced by each one. These two characteristics of the sample directly reflected how well the interviewees knew the QR code, and 71.4% had seen or used the technology in different situations in Sao Carlos, while in Marilia, more than half (54.3%) of the respondents did not know it. Fig. 3 presents a comparison of the situations in which the interviewees of the two cities knew/used the QR code before the survey.

In order to verify the information that should be made available by the companies / products in the QR codes, the interviewees pointed out the ones that they considered relevant in the purchase decision for four different categories of products previously established: meat, alcoholic beverages, FVs, and other products (grocery, baking, and own production). Tables 2 and 3 present these results for the cities of Sao Carlos and Marilia, respectively.

Table 2. Information considered more critical by consumers of Sao Carlos in the purchase decision for meat, alcoholic beverages, FVs and products of grocery, baking and own production.

Base		35									
Meats	A.N.	%	Alcoholic beverages	A.N.	%	FV	A.N.	%	Other products	A.N.	%
Lot	16	45.7	Grape variety	24	68.6	Expiration date	32	91.4	Manufacturer	26	74.3
Breed	13	37.1	Region	21	60.0	Lot	16	45.7	Gluten	29	82.9
Age	20	57.1	Harvest	24	68.6	Link (access to report)	15	42.9	Dye	26	74.3
Technical manager	12	34.3	Ground	6	17.1	Harvest date	26	74.3	Sodium	32	91.4
Location	13	37.1	Climate	9	25.7	Date of production	15	42.9	Trans fat	31	88.6
Distributor	20	57.1	Color	13	37.1	Farm of origin	22	62.9	Sugar *	5	14.3
Fridge	31	88.6	Aroma	13	37.1	Defensive	25	71.4	Lactose *	4	11.4
SIF	28	80.0	Palate	20	57.1	Variety	17	48.6	Monosodium glutamate *	1	2.9
Date of slaughter	26	74.3	Winemaking	5	14.3	Organic	31	88.6			
Property name	15	42.9	Aging	19	54.3	Producer	11	31.4			
Name of producer	13	37.1	Bottling	9	25.7	Planting date	8	22.9			
Total area	3	8.6	Alcohol Content	20	57.1	Harvest date / Time	8	22.9			
Legal reserve area	13	37.1	Total acidity	15	42.9	Existence of waste	24	68.6			
Date of the last vaccines	24	68.6	pH	12	34.3	Processor	9	25.7			
food	24	68.6	Suggestion for harmonization	17	48.6	Processing date	14	40.0			
Carcass finishing	10	28.6	Conservation	20	57.1	Property name	8	22.9			
Certifications	28	80.0	Longevity	13	37.1	Location	18	51.4			
			Operating Temperature	19	54.3	Distributor	24	68.6			
Total	309			279			323			154	

M.A.

Source: Elaborated by authors from data research

There was a more significant difference in the meat information on the slaughter production lot (45.7% for Sao Carlos and 71.4% for Marilia), the name of the slaughterhouse (88.6% for Sao Carlos and 68.6 % for Marilia) and name of the rural property (60.0% for Sao Carlos and 25.7% for Marilia).

About alcoholic beverages, the information highlighted referred to the wine. It was observed that the consumers interviewed in Sao Carlos had the habit of consuming

more frequently than those approached by the research in the supermarket of Marilia. Therefore, the result showed a greater difference in the information considered most relevant for grape variety (68.6% for São Carlos and 54.3% for Marília), production region (42.9% and 40.0%, respectively), palate (57.1% and 45.7%, respectively), suggestion of harmonization (48.6% and 28.6%, respectively), longevity (37.1% and 22.9%, respectively) and temperature (54.3% and 42.9%, respectively).

Table 3. Information considered more critical by consumers of Marilia in the purchase decision for meat, alcoholic beverages, FVs and products of grocery, baking and own production.

Base		35									
Meats	A.N.	%	Alcoholic beverages	A.N.	%	FV	A.N.	%	Other products	A.N.	%
Lot	25	71.4	Grape variety	19	54.3	Expiration date	31	88.6	Manufacturer	27	77.1
Breed	15	42.9	Region	14	40.0	Lot	24	68.6	Gluten	29	82.9
Age	19	54.3	Harvest	21	60.0	Link (access to report)	14	40.0	Dye	28	80.0
Technical manager	16	45.7	Ground	10	28.6	Harvest date	23	65.7	Sodium	32	91.4
Location	18	51.4	Climate	11	31.4	Date of production	21	60.0	Trans fat	32	91.4
Distributor	24	68.6	Color	10	28.6	Farm of origin	17	48.6	Sugar *	3	8.6
Fridge	24	68.6	Aroma	12	34.3	Defensive	19	54.3	Lactose *	4	11.4
SIF	33	94.3	Palate	16	45.7	Variety	21	60.0	Monosodium glutamate *	2	5.7
Date of slaughter	24	68.6	Winemaking	10	28.6	Organic	30	85.7			
Property name	9	25.7	Aging	19	54.3	Producer	18	51.4			
Name of producer	11	31.4	Bottling	14	40.0	Planting date	11	31.4			
Total area	5	14.3	Alcohol Content	19	54.3	Harvest date/ Time	14	40.0			
Legal reserve area	15	42.9	Total acidity	16	45.7	Existence of waste	25	71.4			
Date of the last vaccines	28	80.0	pH	12	34.3	Processor	14	40.0			
food	27	77.1	Suggestion for harmonization	10	28.6	Processing date	20	57.1			
Carcass finishing	13	37.1	Conservation	18	51.4	Property name	9	25.7			
Certifications	27	77.1	Longevity	8	22.9	Location	12	34.3			
			Operating Temperature	15	42.9	Distributor	22	62.9			
Total	333			254			345			157	

M.A.

Source: Elaborated by authors from data research

In the FV category, the most significant differences were found for production batch information (45.7% for São Carlos and 68.6% for Marília), date of production (42.9%

and 60.0%, respectively), (31.4% and 51.4%, respectively), the name of the processor (25.7% and 40.0%, respectively), processing date (40.0% Sao Carlos

and 57.1%, respectively) and location, which can be applied to the property, processor or distributor (51.4% and 34.3%, respectively).

Finally, the information of the category other products, which included grocery, bakery, and own products, were the most similar, possibly because it was a set of information of greater consumer domain, being widely disseminated and discussed, which are the nutritional table information.

Finally, analyzes of the correlation between the variables of the consumer profile and the information considered necessary in the purchase decision for the categories of products surveyed were carried out: meat, alcoholic beverages, FV and other products (grocery, baking, and own manufacturing). Table 4 presents the results found for the category 'meats.'

There was a greater concern of women (significant association of moderate to low) with information about the animal's consumption during its creation (62.7%), information on production certification (59.3%) and information (69.6%), although this information was not considered essential for two-thirds of the respondents (67.1%).

Information about the slaughterhouse and the carcass finishing had a moderate association with the level of education of the interviewees. The first was considered significant for the purchase decision among 52.7% of those with higher schooling (30.9% with complete higher education and 21.8% with post-graduation), while the animal's carcass finishing proved to be relevant information for only 32.9% of the interviewees, is more important for the purchase decision of those who own secondary education (47.8%).

Table 4. P-values of the chi-square test of the association of the variables of the consumer profile with information about the product considered necessary in the decision to buy meat.

INFORMATION - MEAT	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Lot	0.097	0.417	0.381	0.071	0.097	0.985	0.242	0.393	0.177	0.702
Breed	0.016	0.894	0.351	0.124	0.329	0.180	0.254	0.341	0.180	0.685
Age	0.151	0.208	0.125	0.955	0.348	0.131	0.220	0.497	0.278	0.249
Technical manager	0.219	0.067	0.341	0.149	0.215	0.663	0.182	0.680	0.311	0.147
Location	0.066	0.580	0.289	0.322	0.206	0.707	0.277	0.251	0.225	0.472
Distributor	0.134	0.263	0.328	0.185	0.202	0.721	0.133	0.871	0.235	0.425
Fridge	0.144	0.227	0.418	0.032	0.372	0.084	0.152	0.805	0.212	0.532
SIF	0.065	0.588	0.273	0.391	0.382	0.070	0.205	0.567	0.210	0.545
Date of slaughter	0.036	0.762	0.294	0.301	0.387	0.062	0.212	0.534	0.396	0.027
Property name	0.079	0.507	0.205	0.708	0.291	0.314	0.192	0.632	0.327	0.112
Name of producer	0.112	0.348	0.186	0.789	0.198	0.740	0.278	0.249	0.243	0.389
Total area	0.021	0.863	0.337	0.159	0.151	0.902	0.120	0.909	0.329	0.109
Legal reserve area	0.019	0.873	0.253	0.482	0.254	0.476	0.145	0.831	0.183	0.673
Date of the last vaccines	0.199	0.095	0.235	0.568	0.433	0.022	0.208	0.552	0.311	0.148
Food	0.325	0.007	0.336	0.161	0.333	0.171	0.290	0.208	0.357	0.063
Carcass finishing	0.234	0.050	0.460	0.011	0.423	0.028	0.251	0.353	0.289	0.212
Certifications	0.236	0.049	0.172	0.838	0.363	0.100	0.339	0.090	0.211	0.538

Subtitle:

Bold: Significant association at 5%.

Source: Elaborated by the authors from the research data

Carcass finishing also showed a moderate association with the variable age group. This information was not considered essential for 67.1% of the interviewees, and

the incidence of this association was higher for consumers between 25 and 34 years (34.0%) and 35-44 years (29.8%). On the other hand, knowing the date of the last

vaccines applied in the animals is a concern of 75.7% of the interviewees, also presenting a moderate significant association between these same age groups (32.1% and 26.4%, respectively).

The date of the slaughter of the animal was another information that showed a significant association with the family income of 71.4% of the interviewees, concentrating mainly among consumers with an income of up to five minimum wages (64.0%).

Table 5 presents the results found for the category 'alcoholic beverages.'

Information on the aging process of the beverage (wine, in the example) and suggestion of food harmonization showed a moderate association with the degree of education, the first information being most valued by most consumers (54.3%) who are attending (31.6%), and the second, considered to be less critical for purchasing decisions for the majority of respondents (61.4%), of which 39.5% high school. The results suggest that this information has its importance increased as people qualify more, because of the 38.6% who considered this information relevant, the majority (59.3%) have completed higher education or are postgraduate.

Table 5. P-values of the chi-square test of the association of the variables of the consumer profile with information about the product considered necessary in the decision to purchase alcoholic beverages.

INFORMATION - ALCOHOLIC BEVERAGES	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Grape variety	0.105	0.379	0.277	0.373	0.247	0.509	0.222	0.484	0.163	0.760
Region	0.056	0.642	0.316	0.223	0.343	0.144	0.218	0.504	0.203	0.579
Harvest	0.134	0.263	0.226	0.611	0.238	0.555	0.133	0.871	0.107	0.939
Ground	0.065	0.588	0.205	0.711	0.341	0.148	0.091	0.965	0.309	0.154
Climate	0.036	0.762	0.310	0.242	0.318	0.214	0.301	0.175	0.158	0.781
Color	0.010	0.936	0.321	0.206	0.267	0.417	0.259	0.321	0.264	0.300
Aroma	0.073	0.544	0.155	0.892	0.372	0.085	0.206	0.565	0.142	0.842
Palate	0.086	0.473	0.167	0.856	0.258	0.457	0.179	0.691	0.151	0.808
Winemaking	0.065	0.588	0.072	0.996	0.275	0.382	0.337	0.093	0.238	0.412
Aging	0.053	0.660	0.402	0.046	0.366	0.095	0.246	0.374	0.323	0.121
Bottling	0.023	0.848	0.295	0.297	0.258	0.461	0.133	0.871	0.288	0.215
Alcohol Content	0.050	0.678	0.267	0.418	0.371	0.087	0.169	0.736	0.102	0.947
Total acidity	0.035	0.767	0.123	0.958	0.297	0.291	0.235	0.423	0.100	0.952
pH	0.019	0.874	0.212	0.679	0.200	0.729	0.204	0.574	0.176	0.705
Suggestion for harmonization	0.160	0.180	0.404	0.044	0.239	0.547	0.229	0.451	0.149	0.819
Conservation	0.195	0.103	0.220	0.641	0.263	0.437	0.160	0.772	0.205	0.566
Longevity	0.067	0.574	0.260	0.449	0.225	0.617	0.221	0.493	0.153	0.801
Operating Temperature	0.116	0.331	0.356	0.114	0.417	0.033	0.364	0.055	0.218	0.504

Subtitle:

Bold: Significant association at 5%.

Source: Elaborated by the authors from the research data

The service temperature was another important information for approximately half of the interviewees (48.6%), with a significant moderate association, mainly with the age group of 25 to 34 years (44.1%).

Table 6 presents the results found for the category 'fruits and vegetables (FV).'

The information on the application of pesticides in the production of FV showed a moderate association with

three variables of the profile of the respondents: education level, age group, and marital status. Approximately two-thirds of the respondents (65.7%) with higher education (56.5% with full and post-graduate education), aged between 25 and 44 years (63.0%) and married (71.7%) considered this information relevant.

Other verified associations referred to the information on the name of the rural producer with the degree of

education (moderate significant association) and were not considered essential for 55.7% of respondents (61.5% with full tertiary and post-graduate education). The association of property name with gender (low significant association), showed that this information was not considered necessary for 78.6% (of which 60% were women), while 73.3% of those who considered this

information necessary for decision making were men. When the name of the distributor is associated with family income (significant association of moderate to low), this information is considered essential for 65.7% of respondents, the majority (58.7%) with family income between one and five minimum wages.

Table 6. P-values of the chi-square test of the association of consumer profile variables with product information considered necessary in the decision to buy fruits and vegetables (FV).

INFORMATION - FV	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Expiration date	0.067	0.576	0.322	0.203	0.394	0.054	0.125	0.894	0.254	0.341
Lot	0.107	0.369	0.342	0.146	0.232	0.586	0.158	0.782	0.200	0.590
Link (access to report)	0.039	0.744	0.173	0.837	0.236	0.564	0.255	0.335	0.202	0.580
Harvest date	0.036	0.762	0.220	0.642	0.292	0.309	0.139	0.852	0.155	0.796
Date of production	0.143	0.231	0.252	0.486	0.151	0.903	0.246	0.374	0.044	0.998
Farm of origin	0.062	0.602	0.339	0.153	0.260	0.452	0.189	0.645	0.228	0.458
Defensive	0.079	0.507	0.403	0.044	0.535	0.001	0.502	0.001	0.276	0.256
Variety	0.165	0.167	0.247	0.511	0.268	0.411	0.188	0.651	0.171	0.728
Organic	0.200	0.094	0.177	0.823	0.233	0.580	0.150	0.813	0.293	0.199
Producer	0.137	0.250	0.428	0.025	0.344	0.142	0.180	0.688	0.258	0.325
Planting date	0.067	0.574	0.242	0.537	0.155	0.891	0.180	0.685	0.126	0.892
Harvest date/Time	0.100	0.401	0.146	0.913	0.175	0.827	0.264	0.300	0.132	0.876
Existence of waste	0.163	0.173	0.142	0.923	0.273	0.390	0.212	0.534	0.221	0.491
Processor	0.162	0.175	0.312	0.234	0.298	0.287	0.186	0.660	0.097	0.957
Processing date	0.002	0.989	0.232	0.586	0.236	0.563	0.263	0.305	0.273	0.265
Property name	0.274	0.022	0.388	0.062	0.245	0.522	0.124	0.898	0.206	0.562
Location	0.062	0.602	0.328	0.185	0.216	0.661	0.207	0.558	0.275	0.260
Distributor	0.102	0.395	0.306	0.257	0.278	0.368	0.271	0.273	0.368	0.050

Subtitle:

Bold: Significant association at 5%.

Source: Elaborated by the authors from the research data

Table 7 presents the results found for the category 'other products (grocery, baking and own manufacturing).'

This set of information was what consumers most indicated as being essential for decision making, probably because they are more familiar with its terms and meanings. Therefore, the results of this group did not present a significant association, except for the information on cholesterol, which was pointed out as crucial by only 1.8% of the interviewees, all over 66 years of age, with a moderate association.

V. CONCLUSION

The work focused on the use of QR code technology in the packaging of products by agri-food companies, verifying the available traceability information and its reflexes in the decisions of the consumers. The analyzes presented a consumer profile with higher education and family income in Sao Carlos than in Marilia. These consumers, in turn, were more familiar with QR code technology, including packaging of agri-food products, though most of the time they had not made use of it.

Consumer preference for traceability information has reinforced companies' notion of the importance of information in most cases. In this study, it was observed

that younger female consumers with higher schooling and income are more concerned with information about traceability and product quality. This information relates to feeding the animal during the production process, dates of the last vaccines, slaughtering, and certification of production in the case of meat, the aging process, a suggestion of harmonization and temperature of service in the case of wines, and use of pesticides in the case of FV.

Already information on carcass finishing for meat, and the name of the producer and the rural property, for FV, were not considered essential for most interviewees.

In this way, the results suggest that there is a higher predisposition of consumers for less technical and more commercial information, possibly because the traceability information is of lesser knowledge and domain of the interviewees.

Table 7. P-values of the chi-square test of the association of consumer profile variables with product information considered necessary in the decision to purchase other products (grocery, baking and self-made).

INFORMATION - OTHER PRODUCTS	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Manufacturer	0.075	0.532	0.196	0.749	0.253	0.481	0.113	0.925	0.213	0.531
Gluten	0.064	0.592	0.171	0.844	0.345	0.140	0.168	0.739	0.347	0.077
Dye	0.043	0.719	0.326	0.189	0.296	0.293	0.188	0.650	0.197	0.606
Sodium	0.137	0.250	0.329	0.182	0.346	0.137	0.213	0.528	0.263	0.304
Trans fat	0.183	0.127	0.295	0.298	0.364	0.098	0.136	0.861	0.286	0.222
Sugar *	0.021	0.862	0.249	0.503	0.236	0.566	0.131	0.879	0.365	0.053
Lactose *	0.111	0.355	0.225	0.616	0.328	0.184	0.224	0.478	0.305	0.164
Monosodium glutamate *	0.114	0.341	0.231	0.590	0.172	0.839	0.172	0.722	0.241	0.398
Cholesterol	0.127	0.286	0.197	0.743	0.569	0.000	0.104	0.944	0.241	0.398

Subtitle:

Bold: Significant association at 5%.

Source: Elaborated by the authors from the research data

The main contribution of this research is based on the survey of the information that the interviewed consumers consider essential for the purchase decision of agri-food products, constituting a vital reference so that the companies that currently work with traceability, be it industry or retail, can improve their labels, adding value to the marketed product.

On the other hand, it is essential to recognize that the nature of the theme chosen confers some limitations to the results obtained. The first one concerns the focus of the research, since the consumers, although open, often answered questions hurriedly, which may have led to presenting unrealistic data, by mistrust or even discrediting the purpose of this investigation.

Another limitation, justified by the methodology used, refers to the fact that the sample of the study was restricted to the consumers that were in the retail equipment itself, in addition to the low number of interviewees, which does not make possible a generalization of the results found. However, despite these limitations, it is believed that the present study can be used as a starting point for other researches, testing

new information and other products, making even possible comparisons.

Regarding future research, in addition to expanding the universe surveyed, this study may pave the way to answer, in more depth, questions related to the information available, of great relevance to companies and consumers, increasingly interested in knowing the origin of what they consume.

As a suggestion, the continuity of work may occur with the application of new research to other product categories, to test new sets of information, or even applying new techniques of data collection to consumers.

ACKNOWLEDGEMENTS

The authors acknowledge the Scientific and Technological Development Council - CNPq (408819/2013-8) for financial support that enabled the execution of this research.

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