Predicting Consumers' Likelihood to Scan QR Codes to Identify Bioengineered Food Ingredients

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Introduction/Need for Research

President Barack Obama signed the National Bioengineered Food Disclosure Standard on July 29, 2016, which defined bioengineered food as any food that "contains genetic material that has been modified through in vitro recombinant deoxyribonucleic acid (DNA) techniques and for which the modification could not otherwise be obtained through conventional breeding or found in nature" (p. 1). This law has altered the way the food industry communicates with consumers, creating a challenge for how manufacturers display their food labels on packages while providing access to additional information through a website link, telephone number, or a Quick Response (QR) code (National Bioengineered Food Disclosure Standard, 2016). Given the increasing importance of mobile devices and especially of QR code, it is important to understand how consumers would react to the entry of such technology in their grocery shopping habits, in accordance to Research Priority Area Two of the National Research Agenda (Roberts, Harder, & Brashears, 2016). This study's purpose was to discover consumers' use of disclosure methods and their purchasing intention of bioengineered food. The objective addressed in this manuscript was to predict consumers' intention to use their smartphone's QR code reader to learn whether a product contains bioengineered food ingredients based on their attitude, trust, smartphone and QR code experience, and demographic characteristics.

Theoretical Framework

Rogers' diffusion of innovation theory was the theoretical framework for this study. Diffusion seeks to explain how a new product is adopted, and five factors impact the diffusion process and the rate of adoption: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). This study focused on the characteristic of compatibility as it pertains to the degree to which using QR codes fit with consumers' existing values, past experiences, and needs. Consumers trust consumer organizations, environmental groups, and scientists more than government and industry as information sources for guidance when making decisions related to bioengineered food (Bredahl, Grunert, & Frewer, 1998; Gaskell, Allum, & Stares, 2003; Hunt & Frewer, 2001). From survey results of 800 general election voters, fewer than 1-in-4 respondents have ever scanned a QR code or bar code for learning about a food product (The Mellman Group, Inc., 2015). Sixteen percent of respondents who are the primary shopper in their household have scanned a QR code to get information. A survey of 525 U.S. adults indicated that 21.3% of respondents were very likely and 32.3% were somewhat likely to scan QR codes with their smartphones to determine if ingredients were bioengineered (Berning & Roe, 2017).

Methods

An online survey was created, reviewed by a panel of experts, and used to collect data. SurveyMonkey disseminated the survey using a non-probability opt-in sampling technique to 523 U.S. residents 18 and older (Baker et al., 2013). Four hundred fifty-six responses were usable, yielding an 87% response rate. The data were weighted according to the 2010 U.S. Census to increase generalizability of the study's results (Baker et al., 2013). The questionnaire addressed respondents' attitude toward GM food, level of trust for sources from which they got information about bioengineered food, likelihood to use disclosure methods to learn whether

products contain bioengineered ingredients, smartphone and QR code experience, and demographic characteristics. The ordinal logistic regression was run using SPSS.

Results

A proportional-odds cumulative ordinal logistic regression was calculated to determine the effect of attitude toward bioengineered food, trust of information sources, age, gender, past behavior of using a QR code on food products, ability to make phone calls at grocery stores, and access to the internet on smartphone at grocery stores on the likelihood to use their smartphone to scan QR codes to access information about bioengineered ingredients in food products. The analysis resulted in a statistically significant model, predicting the dependent variable over and above the intercept-only model, $\chi^2(17) = 102.797$, $p < .001$. Thirteen variables in the final model accounted for 21.9% of the variance, with five of those variables being significant predictors (see Table 1).

Table 1
Ordinal Logistic Regression Predicting Consumers' Use of Smartphone QR Code Reader to Access Bioengineered Ingredient Information on Food Products

Predictor	*ß*	*SE*	*OR*	*95%CI*	*Wald test*	*p*
Access to Wireless Internet	-1.352	0.30	0.259	[.145, .462]	20.926	.000
Ability to Make Phone Call	0.047	0.42	0.047	[.456, 2.409]	0.012	.911
Previous Use of QR Code Reader	-0.976	0.21	0.377	[.251, .566]	22.179	.000
Gender	0.060	0.19	1.062	[.733, 1.539]	0.102	.750
Age	-0.004	0.01	0.996	[.985, 1.006]	0.600	.439
Scientists	0.499	0.26	1.648	[.991, 2.739]	3.712	.050
Food Manufacturers	0.113	0.22	1.119	[.721, 1.737]	0.253	.615
Consumer Groups	-0.681	0.24	0.506	[.316, .810]	8.034	.005
Environmental Groups	0.010	0.22	1.010	[.653, 1.562]	0.002	.963
Health Professionals	-0.073	0.27	0.929	[.549, 1.574]	0.074	.929
Regulatory Agencies	0.162	0.21	1.176	[.787, 1.758]	0.626	.429
Farmers	0.351	0.20	1.421	[.957, 2.110]	3.037	.081
Attitude	-0.239	0.06	0.787	[.696, .890]	14.512	.000

Note. CI = confidence interval for odds ratio (OR)

Conclusions/Recommendations/Implications

Access to wireless internet, ability to make calls on their smartphones, trust, attitude, certain information sources, age, and gender accounted for 21.9% of the variance. Attitude towards bioengineered products predicted likelihood to use the QR code app on a smartphone, which was expected since attitude has influenced interest in and purchase of bioengineered food. It was not surprising that regulatory agencies and food manufacturers were not significant predictors since government agencies and industry are least trusted. This research provides a customer profile from which agricultural communicators can use to provide biotechnology and nutritional information beyond an on-package food label, offering better transparency and communication between consumers and agri-food manufacturers. Additional research should measure consumers' reactions to the types and amounts of information sought and received since the U.S. Secretary of Agriculture has to determine the language and symbols used in any disclosure.

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