

News from EU research

FoodSMART project – Shaping Smarter Consumer Behaviour and Food Choice

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Abstract

Compared to meals prepared at home, meals eaten out tend to contain more calories, total fat and saturated fat and it is here where the consumer has very little knowledge of the nutrient profile of the dish they are eating. The aim of the FoodSMART project is to develop an innovative technical (ICT) menu solution that enables informed consumer choice that takes into account individual preferences (such as dietary requirements) as well as product (specification).

Results suggest that in all four European countries (Denmark, France, Greece and UK) the criteria of nutrition, naturalness and value for money were those most valued by consumers presented ideally within a traffic light model. The app was developed and then tested using the System Usability Scale (SUS) which revealed;

- Participants were interested in the FoodSMART project and the information provided. 76% of them were particularly interested in nutritional composition of their dishes and 67% in allergen information.
- 80% of participants would like to have access to this information daily at their company's restaurant.
- Participants found the FoodSMART project app easy to use – 89% agree that 'most people would learn to use this app very quickly'.
- 73% disagree that they 'need to learn a lot of things before they could use it'.
- Overall this application appears not complex, easy to use and could be used frequently (83%).

Keywords; Eating out, food information, app development, consumer behaviour

Introduction

Currently there is much interest regarding the provision of food out of home with consultation by the UK Government to ensure consumers have access to clear and accurate information about the calorie content of dishes on offer (Public Health England, 2018). Eating out has become an integral part of modern life for many people with one in six meals consumed out of home in restaurants, cafés or public food settings such as workplace canteens (Benelam, 2009). However, compared to meals prepared at home, the consumer often has very little control or knowledge of the ingredients, their provenance or nutrient profile (Bray and Hartwell, 2018). In fact, food consumed outside the home is typically of poorer nutritional quality and served in larger portions (Sinclair et al., 2014). There is a positive association between the rise in eating out, higher energy intakes and increasing rates of obesity, a major health and wellbeing societal challenge in many Western nations (Kim et al., 2014). This is of particular salience in the context of the workplace where the contribution of meal served could be an important element of the overall diet due to the frequency of use with many canteens being visited for daily main meal consumption (Mintel, 2017). Public food settings particularly are environments where there is an increased offer (availability), placement and promotion (accessibility) of unhealthy calorie-dense food and beverages (Evenhuis et al., 2018). In a pooled analysis of studies that included food labeling on menus it has been found to reduce consumers' intake of; calories by 6.6 percent, total fat by 10.6 percent and other unhealthy food options by 13 percent (Shangguan et al., 2019). This background formed the rationale for the development of the FoodSMART project app, designed to deliver personalised dish information to consumers via phones or tablets.

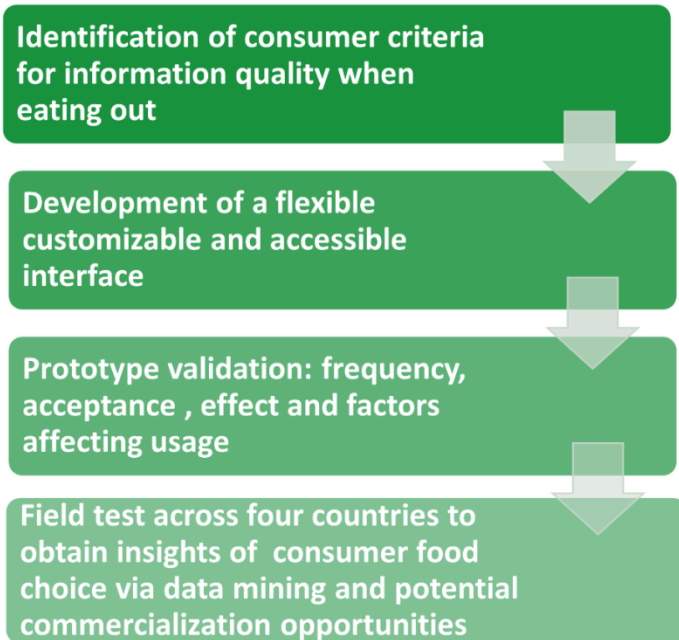
The project received funding from the EU Horizon 2020 programme within the RISE framework (www.foodsmartproject.net) and is a consortia of academics from the University of Copenhagen and the University of Macedonia, industry representatives from the Insitute Paul Bocuse (France) and Ronge and Partner (Austria), led by the Foodservice and Applied Nutrition Research Group at Bournemouth University. This research links a multidisciplinary academic base encompassing marketing, consumer studies, nutrition, public health, psychology, ICT, sociology, foodservice and culinary expertise while providing an inter-sectoral platform for a long-term research collaboration with industry and a mechanism for the commercial exploitation of results.

App development

The work was undertaken in three stages (See Figure 1). Firstly, the requirements for the app were defined through consideration of current legislative and scientific literature and through consultation with potential end-users. Secondly, a prototype was designed and proof of concept

assessed. Finally, field tests were conducted in four countries (Denmark, France, Greece and UK) and the app evaluated using the System Usability Scale (SUS) questionnaire and qualitative feedback.

Figure 1; App Development



Full ethical approval was granted from Bournemouth University Research Ethics Committee, prior to commencement. The research complied fully with Directive 95/46/EC of the European Parliament on the Protection of Individuals and with Directive 2002/58/EC of the European Parliament concerning the processing of personal data and the protection of privacy.

STAGE 1: DEFINING THE APP REQUIREMENTS

METHODS

Conducting a full literature search current legislation for the EU and the US was obtained from the European Union and the US Federal Food and Drug Administration, respectively. In addition consumer consultations were undertaken using one mixed methods study comprising a qualitative and then quantitative component (Price et al, 2016). Briefly, this stage used eight focus groups of canteen users (n=40), two groups in each of four European countries (Denmark, France, Greece, UK), to elicit the criteria used for making food-based decisions in a canteen scenario, and preferred formats of food information provision. The decision-related criteria were then used in a best-worst scaling questionnaire to ascertain the relative importance of these criteria for making food-based decisions in 452 employees (Denmark n=100, France n=100, Greece n=100, UK n=152), who had access to a canteen at their place of work. Formats of food information were also considered in a second best-worst scaling questionnaire administered to the same individuals to ascertain most preferred format for the provision of food information. The best-worst scaling method requires

respondents to choose their most preferred and least preferred option of several sets, allowing relative assessments of the criteria of interest without the use of absolute judgements that can differ between contexts and cultures.

RESULTS

Providing tailored information facilitates the adoption of healthier nutrition practices and such a concept has been supported empirically in retail situations. Signposting specific values of interest enables consumers to utilise labels more effectively without being overwhelmed by the abundance of information given. Results suggest that in all four European countries, the criteria of nutrition (allergens), naturalness and value for money were those most valued by consumers, followed by criteria based on animal welfare, organic foods and provenance, followed by those of environmental impact and fair trade (Price et al, 2016) and where the formats most preferred were traffic light labelling, information boxes and quality assurance markings. Latent class cluster models also identified five clusters of consumers in relation to information use, described as 'Heuristic Processors' (individuals who preferred easy to find and use information); 'Brand Orientated' (individuals who were persuaded by brand authority); 'Systematic Processors' (individuals who prefer more detailed information); 'Independent Processors' (individuals who use a mix of heuristic and systematic processing'; and 'Tech-Savvy' (individuals who indicated a high preference for technology and interactive displays) (CORDIS, 2018).

STAGE 2: PROTOTYPE AND PROOF OF CONCEPT

METHODS

The app is intended for use in a workplace canteen using a predetermined food menu offering a number of dishes and side dishes per day. Requirements for the app were defined using MoSCoW principles (Must have, Should have, Could have, Won't have), based on the findings from Stage 1 following full consideration by the research team, to ensure wide use of the app and increased generalizability. It was developed for android devices using JAVA script, with reference to the adapted Technology Acceptance Model (TAM) (Davis et al, 1989). This proposes that technology usage is positively predicted by 'perceived usefulness' (the degree to which a person believes that using a particular system would enhance his or her job performance), 'perceived ease-of-use' (the degree to which a person believes that using a particular system would be free of effort), 'perceived enjoyment' (the extent to which the activity of using the [technology] is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated), and 'perceived visual attractiveness' (the degree to which a person believes that the [technology] is aesthetically pleasing to the eye).

RESULTS

MoSCoW principles for the app are presented in Table 1.

Table 1: MoSCoW requirements for the app

	Requirements*
Must have	<ul style="list-style-type: none"> • Provide detailed and accurate dish information as supplied by the manufacturer, including ingredients and allergens • Include nutrient information (calories, sugar, fat, saturated fat, salt) • Include information allowing dietary classifications • Include price per dish, allowing assessments of 'value for money' • Provide the information in an easily accessible format • Enable quick information access, e.g. via a QR code • Allow users to store personal preferences about dietary needs and requirements, e.g. religion, vegetarian, vegan. • Tailor menu presentation based on user profile • Warn users for certain dishes based on user preferences, e.g. allergens, religious dietary needs
Should have	<ul style="list-style-type: none"> • Adopt a traffic light type coding system for the nutritional information • Provide additional detailed information if required • Provide a calorie calculator allowing assessment of a whole meal composed of several dishes • Allow users to set a desired calorie limit per dish • Allow presentation of all dishes to retain free choice for the consumer while retaining a tailored presentation based on user profile
Could have	<ul style="list-style-type: none"> • Provide information about ingredient provenance and organic nature • Provide information about animal welfare, environmental impact, and fair trade nature of all ingredients • Enable recommendations based on user preferences • Store previous purchase history • Provide personalized food messages for each user • Allow sharing via social media • Allow users to take photos of dishes / meals chosen • Allow users to search for dishes • Allow users to access menus in advance • Include functionality to feedback comments / suggestions to a canteen
Won't have	<ul style="list-style-type: none"> • Provide generic dish information • Limit consumer choice • Provide information on allergen traces • Provide advertisements • Include functionality to allow users to pay via the app • Include functionality to feedback sales to a canteen

*Definitions:

Dish: can be made up of several food items, e.g. lasagne with side salad.

Food item: something a consumer can buy, which has nutritional facts and can fit a Food Classification.

Nutritional fact: a fact about the nutritional values of a food item (e.g. salt level, sugar level, etc)

Food Classification: information about food items in relation to dietary classifications such as vegetarian, vegan, kosher, halal, etc.

The app was developed as a consumer-facing graphical user interface attached to a back-end database. The back-end database held all required information per dish (ingredients, allergens, nutritional composition), as supplied by caterers and food manufacturers. It was intended that caterers would be given free and unlimited access to the database to upload the information for as many dishes as they wished, based on their own canteen and dish specifications. The user interface was designed to allow consumers to view all information provided and to manipulate the information displayed, through the selection of settings on the user interface indicating personal preferences. Data protection was ensured as all personal information was deposited locally only on the user's device. The app is activated by accessing a menu, or by scanning a QR code placed on a menu or dish label.

Version 1 of the prototype included all features identified as 'must have' and many features identified as 'should have' using the MoSCoW framework. Version 2 included all features identified as 'must have' and 'should have', plus three additional features. Firstly, the information provided per dish was no longer presented on a single screen, but split over three screens (overview / description; nutritional information; ingredients / allergens) to facilitate users accessing only desired information. Secondly, the app included a calorie calculator. This facility allowed consumers to select the dishes they intended to consume, and a value for total calorie content was provided for the meal as a whole. This facility recognises that individuals do not typically only consume single dishes.

The app is currently available for download from the Google play store. A video demonstration of both versions of the prototype app can be viewed in the dissemination section of the project website: www.foodsmartproject.net

STAGE 3: FIELD TEST AND EVALUATION

METHODS

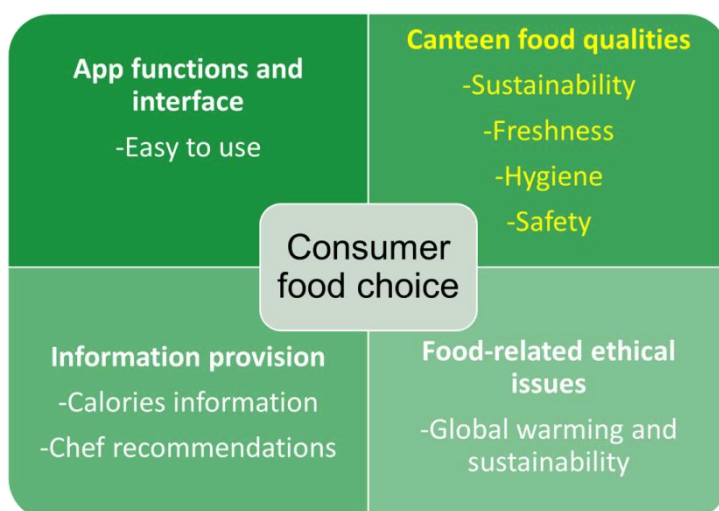
Field tests across Denmark, France, Greece and the UK (n=1031) were conducted for consumers to experience the app in a real life setting. Questionnaires based on the System Usability Scale (SUS) applied during the study consisted of sociodemographic characteristics; consumer evaluation of the app; consumer's perspective on the features of meal content and meal information; personal values (health status, attitudes towards food and related ethical issues), canteen usage frequencies and diet type. The SUS (Brooke, 2013) itself consists of a ten-item questionnaire based on five-point

Likert scales (5=strongly agree to 1=strongly disagree) to assess usability. Five questions are positively phrased: 'I think that I would like to use this system frequently', 'I thought the system was easy to use', 'I found the various functions in this system were well integrated', 'I would imagine that most people would learn to use this system very quickly', and 'I felt very confident using the system'. Five questions are negatively phrased: 'I found the system unnecessarily complex', 'I think that I would need the support of a technical person to be able to use this system', 'I thought there was too much inconsistency in this system', 'I found the system very cumbersome to use', and 'I needed to learn a lot of things before I could get going with this system'. An additional question was also added to the end of the questionnaire 'I believe the FoodSmart App will be useful to customers in a canteen setting to help them to get informed about the dishes offered'. There was also opportunity for respondents to leave open ended comments if desired. The SUS is recommended to assess usability, because it is technology-independent, short (and therefore easy to complete and analyse) and can provide a single score per person. It was chosen for this study because it has been extensively used on a variety of products and systems, notably for measuring the functionality of apps. It is a well-validated instrument and supported by a large pool of comparison data. A ranking of specific attributes of app interface across groups and countries was produced through Principle Component Analysis (PCA) and a subsequent Confirmatory Factor Analysis (CFA) to explore the relationships between factors that influence consumers' food choice.

RESULTS

All of the factors within the questionnaire (i.e. app functions and interface, food qualities, information provision and food-related ethical issues) are significantly positively correlated to consumer food choice (see Figure 2).

Figure 2: Summary of Feld Test



Significant positive correlations are also observed between all the indicator questions and their corresponding factors. The value of the coefficients of each indicator shows the intensity of its influence on the corresponding factor; ease to use app, food freshness, food sustainability, provision of calories and recommendation information. In summary;

- Participants were interested in the FoodSMART project and the information provided. 76% of them were particularly interested in nutritional composition of their dishes and 67% in allergen information.
- 80% of participants would like to have access to this information daily at their company's restaurant.
- Participants found the FoodSMART app easy to use – 89% agree that 'most people would learn to use this app very quickly'.
- 73% disagree that they 'need to learn a lot of things before they could use it'.
- Overall this application appears not complex, easy to use and could be used frequently (83%).

A full report is published on the FoodSmart project web site (www.foodsmartproject.net).

The following common themes emerged from the open ended feedback:

This would be of great interest to me as I regularly diet and count my calories (Female, age 23).

Being able to see calories would affect my decision on what I would buy for lunch (Female, age 24).

Very useful as so many people have different needs (Female, age 21).

It looks like a good convenient app (Male, age 23).

After trialling the app I would be more inclined to using it. As I currently use 'My Fitness Pal' and the FoodSMART project seems to be more accurate (Female, age 22).

The app looks simple to use, so I wouldn't need the use of a technical person (Male, age 24).

Discussion

For decades, printed mediums have been the most common platform used for information provision in an eating out scenario, but digital can deliver richer knowledge in an efficient manner (Ogawa et al, 2012) and may offer a neat solution to the existing constraints highlighted by Din et al. 2012.

Several studies have highlighted the potential that technology may hold in providing information (Lowe et al, 2015), and a small number of smart phone apps have been developed specifically for providing food-based information (Flaherty et al, 2018). 'SmartAPPetite' (2018) encourages people to eat local and healthy food, 'Tapingo' provides university students with canteen-based information

and allows consumers to order food (Barfield, 2014), and the Smartmenu system discussed by Pieskä et al. 2013, allows consumers to browse a menu, check additional information such as nutrient profile, and order items. The potential value of smart phone apps for providing information is also increased by rapidly growing numbers of smart phones with penetration rates of 68.4% in North America and 64.7% in Western Europe and estimations of use by over a third of the world's population (Statista, 2018).

Increased information provision via digital platforms may also enable transparency and evidence of greater integrity for the food service operator (Price et al, 2016²). Consumers with specific dietary needs are often limited in their choices not just by their personal constraints, but also by a lack of information available from serving staff or a lack of trust in the information provided (Lowe et al, 2015) these together with lack of control are key concerns when eating out. Trust is an important component of health-based decision making (Tonkin, 2015), and catering operators that are open and transparent, demonstrate commitment and trustworthiness to consumers. Furthermore, even if the actual content is not always used, consumers can be reassured by the presence of such information (Yepes, 2015). Food operators thus will also potentially benefit from increased information provision.

To enable healthy decision making in an eating-out situation, communication with consumers is clearly required, but any such communication should be carefully considered to ensure that it is well understood, suitable for each consumer, and suited to specific dishes and food operators. Many existing apps use generic recipe data and so provide only generic information (Teixeira et al, 2018). For many consumers, more detailed and specific information is preferable, and more detailed information could increase trust and return business for operators. For communication on allergens, very specific information is required.

This project aimed to develop and evaluate a smart phone application to provide consumers with food-based information in a canteen setting, in a manner that also allowed them to limit and/or personalise the information they received if desired. Initial stages of the work ascertained the information that consumers (legally) should and would like to receive about the food on offer, established the information that consumers would like to personalise, and how they would like to receive this information.

Implications for Practice

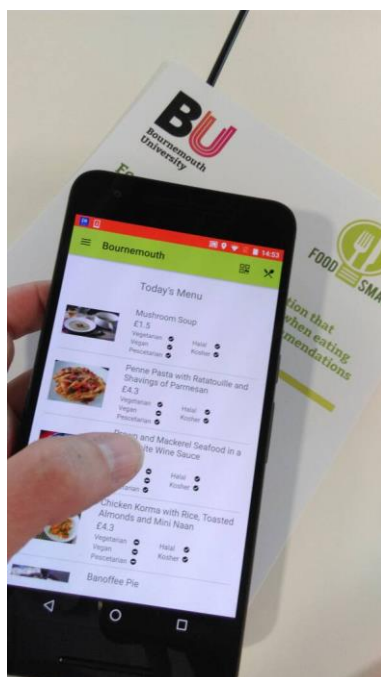
The findings of this research have a number of implications for practice in the provision of food in environments where consumers dine on a consistent basis. Consumers struggle to make choices or

make the wrong decision from a health perspective, partly caused by a lack of nutrient profile information as well as other criteria of concern. The challenge for the foodservice industry is to provide products and services that facilitate and enhance positive food choice in all population segments. Through gaining insight into the perspectives of consumers, information can be provided and in a format that is relevant to enable informed dish decisions. Giving operators the understanding of optimal communication channels can enable a more competitive operator and the opportunity of being considered as part of corporate health. Technical IT solutions could be the future where landing pages in app functionality could appeal to the desire for information or clarification.

Conclusion

The FoodSMART project addresses the Horizon 2020 priorities to produce excellent science, support industrial leadership and defends the societal challenge of Health and Wellbeing. It also encourages two of the main goals, namely to achieve a more competitive and market-oriented sector by strengthening the potential of industry and provide the ability for EU consumers to choose healthier dishes when eating out-of-home. This project offers a scientific evidence based application (app) (Figure 3) combining the best technology and foodservice practice.

Figure 3; FoodSMART project app



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CONFLICTS OF INTEREST

There are no conflicts of interest.

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