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Shaping smarter consumer food choices: The FoodSMART project

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Abstract

Compared to meals prepared at home, meals eaten out of home tend to contain more energy, total fat and saturated fat and it is here where consumers can have very little knowledge of the nutrient profile of the dish they are eating. The aim of the European Union-funded *FoodSMART* project (www.foodsmartproject.net) was to develop an innovative technical menu solution 'app' that enables informed consumer food choice, which takes into account individual preferences (such as dietary requirements) as well as food product specifications, in a workplace canteen setting. A best–worst scaling questionnaire was conducted to identify consumers' functional app requirements and inform the development of personalised food choice messages. Proof of concept was tested using the System Usability Scale in consumers from four European countries (Denmark, France, Greece and the UK). Information on ingredients, nutrition, food 'naturalness' and value for money were those most valued by consumers, with this presented ideally in a personalised way and using a traffic light model. Field trials of the *FoodSMART* app indicated that consumers found it to be simple, easy to use and attractive for frequent use. By gaining insight into the needs of consumers, dietary information can be better tailored and provided in an appropriate format to enable informed food choice.

Keywords: app development, consumer behaviour, food information, out of home

Introduction

Currently, there is much interest regarding the provision of food out of home and whether consumers have access to clear and accurate information about the calorie content of the dishes on offer (PHE 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 used in out of home meals including their provenance and nutrient profile (Bray & Hartwell 2018). Food consumed outside the home is typically of poorer nutritional quality and served in larger portions than home-prepared meals (Sinclair *et al.* 2014). There is a positive association between the rise in the number and frequency of people eating out, higher energy intakes and increasing rates of obesity – a major health and wellbeing challenge in many Western societies (Kim *et al.* 2014). Workplace meals can contribute significantly to overall diet quality due to the

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frequency of consumption, with 43% of employees purchasing their main meal from work canteens on a daily basis (Mintel 2017). These settings, in particular, are environments where there are an increased offer (availability), placement and promotion (accessibility) of less healthy energy-dense foods and beverages (Evenhuis *et al.* 2018). Even knowledgeable individuals often struggle to estimate the number of calories in canteen meals and when diners are provided with accurate nutrition information, their attitude towards specific menu items can change, especially for those dishes which are not aligned with expectations. Calorie information about 'surprising' menu items, such as high-energy salads, can result in the most dramatic shift in attitudes and purchase intentions (Ellison *et al.* 2013). In a pooled analysis of out of home studies that included food labelling on menus, food labelling was found to reduce consumers' energy intake on average by 6.6%, total fat by 10.6% and other less healthy food options such as French fries by 13% (Shangguan *et al.* 2019). Furthermore, tailored dietary information can facilitate the adoption of healthier eating practices in retail situations (Rasberry *et al.* 2007).

The increase in out of home dining and known benefits of food labelling on consumer food choices formed the rationale for the development of the *FoodSMART* project app, designed to deliver personalised dish information to consumers via mobile phones or tablets. An industry database was developed to store and manage information on foods and drinks, such as the nutrient profile and allergen content. The system allows a smartphone/tablet interface to request data which then delivers personalised information based on individual preferences. The app was designed specifically for workplace canteens that use predetermined food menus offering a variety of meals and side dishes per day.

The *FoodSMART* project (www.foodsmartproject.net) received funding from the EU Horizon 2020 programme (2015–2019) within the RISE framework, involved a consortia of academics from the University of Copenhagen (Denmark) and the University of Macedonia (Greece), and industry representatives from the Institute Paul Bocuse (France) and Ronge and Partner (Austria), and was led by the Foodservice and Applied Nutrition Research Group and colleagues at Bournemouth University (UK). The research was multidisciplinary, encompassing marketing, consumer studies, nutrition, public health, psychology, information and communications technology (ICT), sociology, foodservice and culinary expertise. It provided an inter-sectoral platform for long-term research collaboration with industry and a mechanism for the commercial exploitation of results.

The development of the FoodSMART app

The *FoodSMART* app was developed in four stages (see Fig. 1). First, the app requirements were defined through consideration of current legislative and scientific literature; second, consultation with potential end-users was undertaken to develop the user interface; third, a prototype was designed and proof of concept assessed; and finally, field tests were conducted in four countries (Denmark, France, Greece and the UK) and the app evaluated using the System Usability Scale questionnaire (Brooke 2013) and qualitative feedback.

Ethical approval for all studies was granted from Bournemouth University Research Ethics Committee, prior to commencement of the project. 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

Relevant food legislation for the EU was gathered, and a literature search on menu labelling was undertaken. In addition, consumer consultations using qualitative and quantitative methods were conducted to understand the information they would like from the

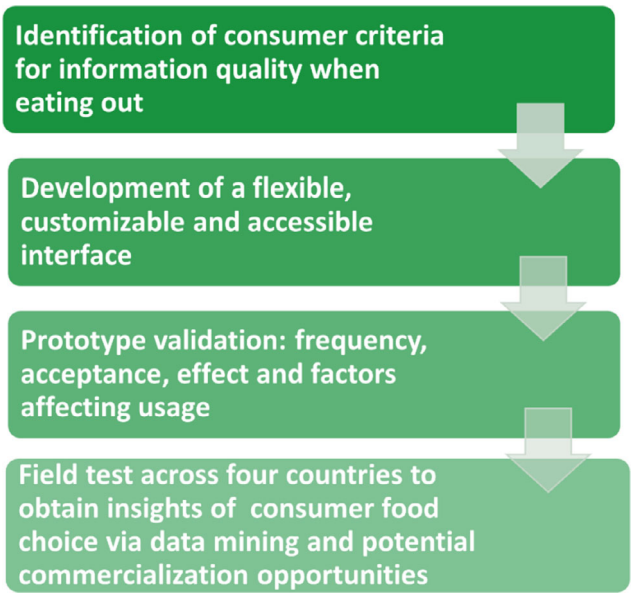

Figure 1 The four stages of the app development for the *FoodSMART* project. [Colour figure can be viewed at wileyonlinelibrary.com]

app (Price *et al.* 2016a; Bray *et al.* 2018). Briefly, in the work of Price *et al.* (2016a), eight focus groups of workplace canteen users ($n = 40$) were conducted, two groups from four European countries (Denmark, France, Greece and the UK), to understand which factors influence their food-based decisions in a canteen setting and their preferred formats of food information provision (*e.g.* health logos, traffic light labelling). The relative importance of the identified influential factors in food-based decision-making was subsequently explored in 452 employees (Denmark $n = 100$, France $n = 100$, Greece $n = 100$, and the UK $n = 152$), who had access to a canteen at their place of work, using a best–worst scaling questionnaire. To ascertain the most preferred format for the provision of food information, a second best–worst scaling questionnaire was administered to the same individuals. The best–worst scaling method (de-Magistris *et al.* 2017) requires respondents to choose their most preferred and least preferred options in a series of sets, allowing relative assessments of the factors of interest without the use of absolute judgements that can differ between contexts and cultures.

Requirements for the app, based on the findings from the literature search, consumer consultations and full consideration by the research team, to ensure wide use of the app and increased generalisability, were then refined in a study using the Must have, Should have, Could have, Won't have (MoSCoW) principles of prioritisation (Clegg & Barker 1994; see Table 1).

Table 1 'Must have, Should have, Could have, Won't have' (MoSCoW) requirements of consumers for the FoodSMART app

	FoodSMART app information
Must have	• Detailed and accurate dish* information as supplied by the manufacturer, including ingredients and allergens • Nutrition information (*e.g.* calories, sugar, fat, saturated fat, salt) • Dietary classification system (*i.e.* in relation to dietary requirements and preferences such as vegetarian, vegan, kosher and halal) • Price per dish, allowing assessments of 'value for money' • Easily accessible information • Information that is quick to access (*e.g.* via a QR code) • A way to store personal preferences about dietary needs and requirements (*e.g.* vegetarian) • The option to tailor menu presentation based on user profile • Warnings about certain dishes based on user preferences (*e.g.* allergens, religious dietary requirements)
Should have	• A traffic light type coding system for the nutritional information • The provision of basic information initially, with an option to also receive additional detail • A calorie calculator to allow assessment of a whole meal composed of several dishes • A way to allow users to set a desired calorie limit per dish • A way to allow presentation of all dishes to retain free choice for the consumer while retaining a tailored presentation based on user profile
Could have	• Information about ingredient provenance and organic nature • Information about animal welfare, environmental impact and fair trade in relation to all ingredients • Recommendations based on user preferences • Information on previous purchase history • Personalised messages for each user (*e.g.* 'this food option will aid calorie control' and 'this food option was selected by you last week') • A way to share information via social media • The option to take photos of dishes/meals chosen • Search function for dishes • Access to menus in advance of the meal • Functionality to feedback comments/suggestions to a canteen
Won't have	• Generic dish information • Limits on consumer choice • Information on allergen traces • Advertisements • Functionality to allow users to pay via the app • Functionality to feedback sales to a canteen

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

Results

Results suggested that in all four European countries, information on the nutritional composition of the food, the food's 'naturalness' (the extent to which fresh ingredients were used and the food was processed, and the amount of additives and preservatives it contained) and value for money were most valued by consumers, followed by information related to animal welfare, organic food production and provenance, with information on the food's environmental impact and fair trade credentials being the least valued (Price *et al.* 2016a). The most preferred formats for nutrition information delivery were traffic light labelling, information boxes and quality assurance markings. Statistical modelling identified five clusters of consumer characteristics in relation to information preference: '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: The FoodSMART app prototype development

The app was developed for Android devices using JAVA script, with reference to the adapted Technology Acceptance Model (TAM) (Davis *et al.* 1989). This model proposes that technology usage is positively predicted by 'perceived usefulness', 'perceived ease of use', 'perceived enjoyment' and 'perceived visual attractiveness'.

The app uses a consumer-facing graphical interface attached to a back-end database, which holds all required information per dish (ingredients, allergens, nutritional composition *etc.*), as supplied by caterers and food manufacturers. It is intended that caterers will be given free and unlimited access to the database to upload the information for as many dishes as they wish, based on their own canteen and dish specifications. The user interface allows consumers to view all information provided and to manipulate which information is displayed, through the selection of settings on the user interface that can be saved as personal preferences. All personal information is deposited locally only on the user's device, ensuring their data are protected. The app is activated by Global Positioning System (GPS) recognition of the canteen 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 in Stage 1 (see Table 1). Version 2 includes all features identified as 'Must have' and 'Should have', plus three additional features. The first is that information provided per dish is no longer presented on a single screen, but split over three screens: (1) overview/description; (2) nutritional information; and (3) ingredients/allergens. This is to facilitate users accessing only desired information. The second additional feature is a calorie calculator. This recognises that individuals do not typically consume only single dishes at mealtimes and allows consumers to select the dishes they intend to consume and generates a value for total calorie content of the meal as a whole. The third additional feature, yet to be fully activated, is a notification system to allow caterers to send messages to users (*e.g.* on special offers and promotions, recommendations or advice).

Stage 3: Validation of the FoodSMART app

Methods

Initial feedback on the app was gained from potential stakeholders and end-users at eight public engagement events in the UK (four events), France, Denmark, Malaysia and China, where mock data were included for demonstration purposes. Questionnaires based on the System Usability Scale (Brooke 2013) assessed the consumers' evaluation of the app. The System Usability Scale consists of a ten-item questionnaire based on five-point Likert scales to assess system usability. Five questions were 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 were 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 added to the end of the instrument 'I believe the *FoodSMART* app will be useful to customers in a canteen setting to help them be informed about the dishes offered'. There was also opportunity for respondents to leave open-ended comments if desired. The System Usability Scale is recommended to assess app usability because it is technology-independent, short (and therefore easy to complete and analyse) and provides a single score per person. It was chosen for this study because it has been extensively used in a variety of products and systems, notably for measuring the functionality of apps, and is validated and supported by a large pool of comparison data (Brooke 2013).

Results

A total of 233 respondents (males and females, of a range of ages) provided responses in a positive direction to all questions on the System Usability Scale, giving a mean overall System Usability Scale score of 68.3 (SD = 15.4) out of 100, and they also provided positive qualitative feedback.

The following themes emerged from the open-ended feedback about the app and example responses are given in Box 1.

(1) It was considered to be good for informing healthy choices.
(2) It was highlighted as particularly useful for those on restricted diets and/or who are health conscious.
(3) It was found to be easy to use. Consumers liked the simple provision of information and the use of the QR code.
(4) Personalised aspects and specific functions of the app were viewed positively.

Stage 4: Field test and evaluation of the FoodSMART app

Methods

Field tests across Denmark, France, Greece and the UK (n = 1031) were conducted to examine consumer experiences of the app in real-life settings. These were assessed using the System Usability Scale plus other questions on features of the meal information provided. Data were also gathered on individual characteristics and values (health status, attitudes towards food and related ethical issues), canteen usage frequencies and diet type. A ranking of specific attributes of the app across countries was produced through principle component analysis, and confirmatory factor analysis was used to explore the relationships between the factors that influence consumers' food choice such as food freshness, food sustainability and provision of calories.

Box 1: Example responses from the open-ended feedback on the FoodSMART app

- 'This would be of great interest to me as I regularly diet and count my calories' (female, 23 years)
- 'Being able to see calories would affect my decision on what I would buy for lunch' (female, 24 years)
- 'Very useful as so many people have different needs' (female, 21 years)
- 'It looks like a good convenient app' (male, 23 years)
- "After trialling the app I would be more inclined to use it. I currently use '(Branded Lifestyle app)' and the FoodSMART app seems to be more accurate" (female, 22 years)
- 'The app looks simple to use, so I wouldn't need the use of a technical person' (male, 24 years)

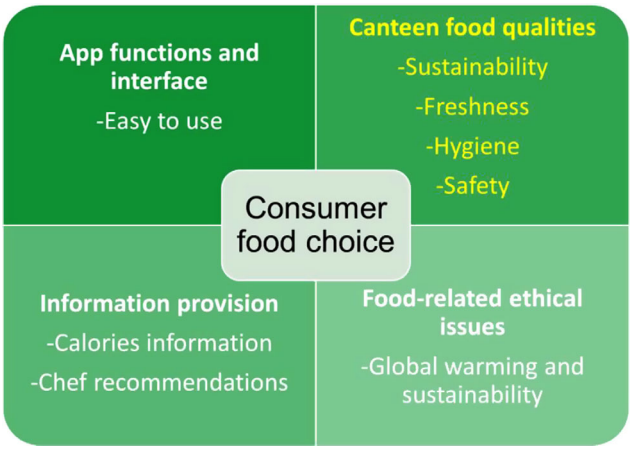

Figure 2 Factors found to influence consumer food choices in the canteen field tests of the FoodSMART app. [Colour figure can be viewed at wileyonlinelibrary.com]

Results

All of the factors within the questionnaire (*i.e.* in relation to app functions and interface, food qualities, information provision and food-related ethical issues) significantly influenced consumer food choice (see Fig. 2).

The findings of the field test are summarised below.

- Participants were interested in the *FoodSMART* app and the information provided. Seventy-six per cent of them were particularly interested in nutritional composition of the dishes and 67% in the allergen information.
- Eighty per cent of participants would like to have access to the *FoodSMART* information daily at their company's restaurant.
- Participants found the *FoodSMART* app easy to use – 89% agreed that 'Most people would learn to use this app very quickly' and 73% disagreed that they 'Need to learn a lot of things before they could use it'.
- Overall, the app was considered to be simple, easy to use and attractive for frequent use.

A full report of the field test findings is published on the *FoodSMART* project website (www.foodsmartproject.net).

Discussion

To enable healthy decision-making in an eating out situation, accurate information about the nutrient profile of the food is required but how this is

communicated should be carefully considered to ensure that it is well understood, appropriate for a range of consumers differing in dietary requirements and preferences, and suited to specific dishes and food operators.

For decades, printed mediums have been predominately used for information provision in an eating out scenario but digital platforms can deliver richer information in a more efficient manner (Ogawa *et al.* 2012). The rapidly growing numbers of smartphone users, 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), highlight the value of using apps and technology to deliver dietary information (Lowe *et al.* 2015). A number of smartphone apps have been developed specifically for providing food-based information in out of home settings (Flaherty *et al.* 2018) but many existing apps use generic recipe data and so provide only general information about the dishes offered (Teixeira *et al.* 2018). For many consumers, more detailed and specific dietary information is preferable and could increase trust and return business for food outlets. For allergens, very specific information is required.

The *FoodSMART* project aimed to develop and evaluate a smartphone app designed to provide consumers with food-based information in workplace canteen settings, 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 the app to include, and how they would like to receive this information.

Information provision via digital platforms can allow food service operators to be more transparent about their offerings and provide evidence of the business' integrity (Price *et al.* 2016b). The choices of consumers with specific dietary needs are often limited by the lack of information provided by the food outlet or a lack of trust in the information provided (Lowe *et al.* 2015). Trust is an important component of health-based decision-making (Tonkin *et al.* 2015) and catering operators that are transparent demonstrate trustworthiness to consumers. Furthermore, even if the food information is not always accessed, consumers can be reassured by the presence of such information (Yepes 2015). Thus, food operators may benefit financially from increased information provision.

Implications for practice

The findings of the *FoodSMART* project have a number of implications for the provision of food information in environments where consumers dine on a regular basis, such as workplace canteens. Consumers can struggle to make healthy food choices because of the lack of nutrition information about the dishes offered. The challenge for the foodservice industry is to provide products and services that facilitate and enhance healthy food choices in all population segments. Through gaining insight into the perspectives of consumers, dietary information can be tailored to align with consumer priorities and provided in an appropriate format to enable informed food choice decisions. In addition, a tool that provides opportunity for food operators to contribute to corporate health can enable a competitive commercial advantage.

Conclusion

The *FoodSMART* project has delivered an evidence-based app (Fig. 3), combining the best technology and foodservice practice, to support consumers in

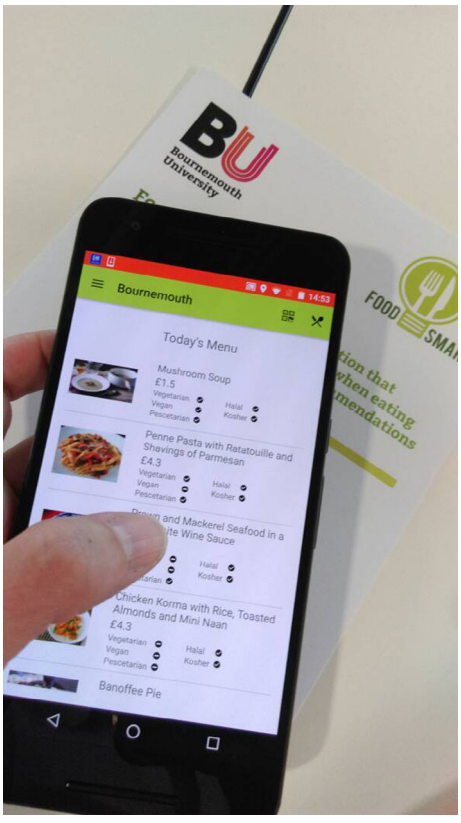

Figure 3 The FoodSMART project app. [Colour figure can be viewed at wileyonlinelibrary.com]

choosing healthier dishes when eating out of home and the food service industry in achieving more competitive and market-oriented offerings. The project has aligned with the Horizon 2020 priorities to produce excellent science, support industrial leadership and address the societal challenge of health and well-being. The app is currently available for download from the Google Play Store. A video demonstration of both versions of the prototype can be viewed in the dissemination section of the project website: www.foodsmartproject.net.

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Conflict of interest

The authors have no conflicts of interest to declare.

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