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*DELIVERABLE Work Package 6*

# D6.1 Interpret and evaluate consumer food choice through data mining and related measured/analytical approaches across countries (Denmark, France, Greece, UK), key stages and organisational settings (universities and workplaces)

Lead Contractor for the D6.1

University of Copenhagen

Final Report

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**DISCLAIMER**

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# PREFACE

The research reported here was supported by Marie Skłodowska-Curie Research and Innovation Staff Exchange (RISE) programme which aims to promote international and inter-sector collaboration through research and innovation staff exchanges and advance science and the development of innovation through sharing knowledge and ideas from research to market and vice versa – FoodSMART Project ID: 643999. The objective of this project is to develop an innovative technical (ICT) menu solution that enables informed consumer food choice while dining out that takes into account individual characteristics, product cues as well as environmental cues. This report disseminates Work Package 6 – Field Study (KU). The objective of WP6 is to conduct a field study across age groups and organisational settings (i.e. universities and workplace canteens) in Denmark, France, Greece and the UK so as to obtain consumer insights through data mining and relevant measured/analytical approaches as well as synthesising and benchmarking the attributes of a successful human-smartphone/tablet interface in preparation for commercialisation. The content of this report refers specifically to the data mining and analytics aspect of the work package. University of Copenhagen (KU) coordinated the work, which is supported by Bournemouth University, Institut Paul Bocuse, Ronge & Partner GmbH and University of Macedonia. Correspondence should be addressed to Federico J. Armando Perez-Cueto, University of Copenhagen, Department of Food Science, Rolighedsvej 26, 1958, Frederiksberg C, Denmark. Tel. +45 60 74 33 90. Email: apce@food.ku.dk.

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# Executive summary

After the identification of consumers preferences and needs for information and decision making in canteen situations by the work conducted in WP2. The FoodSMART app has been developed (WP4), and prototype tested in the field at IPB (WP5). The next critical step is to evaluate its usability by canteen consumers in Denmark, France, Greece and the UK. A study was designed to compare and assess consumer acceptance and potential use of the FoodSMART app among respondents who have never used the FoodSMART app (Control Group) with those having used the app (Test Group), therefore further analytical investigations on the consumer data collected in both control and test situations can be conducted to compare consumer food choice cross four countries, key stages and organization settings. A total number of 1031 adults from Denmark, France, Greece and the UK participated in the study. The study was conducted in two organisation settings (university canteen and workplace canteen) in four countries. The two questionnaires applied during the study consist 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. Both the control and test groups completed the survey, where the test group also experienced the FoodSMART app in a real-life setting. 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) by Structural Equation Modelling (SEM) and developed to mine the survey data collected in control and test situations across countries and organization settings and explore the relationships between factors that influence consumers' food choices in the canteen.

The overall results obtained from mining the data of all the participants from four countries reveal the top indicator for each corresponding factors (app functions and interface, canteen food qualities, information provision and food-related ethical issues). The propriety for app functions and interface is that the app should be easy to use, while that of the food qualities is food sustainability and freshness. The top indicators for information provision are calorie information and chef recommendations. However, the rest of the indicators in the group are relatively equally important. For food-related ethical issues, global warming and sustainability concern consumers the most. The results for country and organisation setting comparisons show that consumers in all four countries seem to share the similar trait of valuing canteen food qualities the most, especially for food sustainability, freshness, hygiene and safety. The consumer preferences for the rest of the factor vary from country to country. No significant conclusions can be drawn regarding differences and similarities in two organisational settings (workplace and university canteen) from the results.

Information regarding the critical stages of food preparation was not captured via the app and the questionnaire, which led to a minor deviation from the planned content.

# INTRODUCTION

Since the introduction of the internet to people's homes and the rapid rise in the number of people owning internet-enabled smartphones and tablets, there has been increased interest in using this technology as a method of delivering behavioural change such as dietary behavioural change (Webb et al. 2010). This technology is mainly experimental and has shown both promise and potential pitfalls (Murray 2012), but it seems inevitable that with the continuing proliferation of technology in our everyday lives, tablets and smartphones will form an important part of the clinical behavioural research for the foreseeable future. The potential for using phones and tablets for behavioural change is significant. Devices such as smartphones and tablets have become rapidly integrated into everyday life, and the latest figures in the UK indicate that more than 90% of 16-24-year-olds own a smartphone (Ofcom 2015). With such high levels of smartphone use, especially among the young, and the potential for automated, instant and free tracking of behaviours as opposed to other expensive interventions, it is clear why the smartphone and tablets have proven to be such a popular means of applying behavioural interventions in the scientific literature in recent years. Smartphone and tablet interventions are increasingly popular due to the increase in coverage and have been proven to be extremely effective in health behaviour changes in various areas (Muessig et al. 2015; Donker et al. 2013; Ehrenreich et al. 2011).

A study has shown that the fat and calorie intake are significantly higher when dining out comparing to eating at home, which can potentially lead to a rise in the prevalence of obesity (Bohm and Quartuccio, 2008). The use of smartphones and tablet technologies such as developing of an innovative technical (ICT) menu solution that enables informed consumer choice when eating out that takes into account different individual characteristics, as well as product and environmental specific cues, can be a potential method of reducing the economic and sociable costs of unhealthy food choices. This also provides further insights into potential commercialisation opportunity (Lowe et al., 2013).

Based on the findings from the previous work packages and other relevant evidence, the prototype of an ICT menu solution (FoodSMART) was developed. The WP6 aims to investigate whether the current prototype is truly effective by testing it in the field across age groups and organisational settings (i.e. universities and workplace canteens) in Denmark, France, Greece and the UK. The results of the WP6 provide interpretation of consumer food choice through data mining and related measured/analytical approaches across countries and organisational settings (universities and workplaces) as well as benchmarks of attributes for potential commercialization in the future that can be a starting point of guiding consumers into healthier and more sustainable food choices in canteens through mobile technologies.

# MATERIALS AND METHODS

A study was developed to address the target questions in WP6 by comparing respondents who have never used the FoodSMART app with those having used the app. The primary aim of the study is to evaluate consumer acceptance and potential use of the app in the field in Denmark, France, Greece and the UK. A questionnaire was designed and then introduced into the study to capture consumer responses in both control and test groups. The intention of using a control group is to present the app concept in a theoretical way (or with a video) and thereafter ask what aspects of the app would be relevant to the participants for further development via questionnaire. In contrast, consumers were able to use the app in real-time during test situations. The survey evaluates whether consumers find it useful and express their intention to use the app. After that, data collected from the study were analysed to obtain consumer insights through data mining and relevant measured/analytical approaches.

## Questionnaire Design

The questionnaire was first conceptualised based on the findings from WP2 that identified consumers' preferences and needs for information and decision making in canteen situations. After which, it was further modified based on expert opinions as well as in-depth interviews with consumers to form the initial structures and core questions to assess the target objectives. It then went through a pre-test phase to evaluate its viability and reliability for further revisions. The final questionnaire was formalised to investigate consumer behaviour with the following questions to target specific consumer insights (Appendix 1 & 2):

- Questions 1-11 are a consumer evaluation of the app after use.
- Questions 12 – 15 are basic sociodemographic information plus subjective health statement.
- Questions 16 – 20 are the frequency of use of the canteen for different purposes.
- Questions 21 – 31 are personal importance given to specific features of the food provided by the canteen.
- Questions 32 – 38 are the needs of information from the foodservice provider.
- Questions 39 – 43 are overall concerns on food issues.
- Question 44 is self-identification as omnivore, vegetarian, vegan or pescatarian.

Except for the questions on basic sociodemographic information, health statement, the frequency of canteen usage and self-identification (question 12-15, 16-29, 44), the other 34 questions were adapted to the Likert 5-point scale: 1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5. Strongly agree. The Likert scale allows more precise capture of consumer insights with continuous variables. The control variables are the same in both test and control situations, allowing the comparison of segments.

## Logistics and Data Collection

The study was conducted in either a university or workplace settings in all four countries with the following timelines and instruments:

| Country | Timeline (Control groups) | Timeline (Test Groups) | ICT used (Smartphone/tablet) | Organization settings |
|---|---|---|---|---|
| **Denmark** | 29/1/2018-30/1/2018 | 21/3/2018-23/3/2018 | Tablet | University Canteen |
| **France** | 20/2/2018 | 20/2/2018 | Tablet | Workplace Canteen |
| **Greece** | 26/1/2018-30/1/2018 | 9/1/2018-12/1/2018 | Tablet | University Canteen |
| **UK** | 9/10/2017<br>16/10/2017<br>23/10/2017 | 9/10/2017<br>16/10/2017<br>23/10/2017 | Tablet | University Canteen |

*Table. 1 Timeline, instruments and organisation settings in four countries*

Each FoodSMART centre contacted catering providers for study explanation and decided whether they were interested in participating. Afterwards, dish information from each participating canteen was obtained and incorporated into the app layout for the later field tests. A standardised protocol was applied to the data collection in all countries with minor adjustments to adapt to real-time situations. On the control day, the app was introduced to consumers in the canteens either verbally or using the video, followed by the completion of control questionnaires by consumers to provide information regarding their views related to the app and canteen food with the target of the collection of the minimum total sample of 100 observations per country. On the test day, consumers completed the test questionnaires after using the application that was modified in accordance to the canteen menu of that day with the target of the collection of the minimum total sample of 100 observations per country. The recruitment of participants occurred randomly on campus or within corporate settings. Only the participants from field test countries were recruited to reduce bias from different cultural backgrounds.

## Data Analysis

After considering the sample size of all four countries, principle component analysis (PCA) and confirmatory factor analysis (CFA) by structural equational modelling (SEM) were chosen to evaluate consumer food choices and compare between control groups and test groups respectively.

-PCA

PCA was used to examine the influencing factors of the use of ICT in canteen among the test groups and control groups of four countries. SPSS 22.0 was used for the analysis of 8 datasets (4 control

groups and 4 test groups). The 34 questions related to the app and canteen food in the questionnaire were analysed by PCA to obtain multiple factor sets (some condensed into 8, 9 and 10). The cumulative variance contribution rate of each factor set was obtained which represents the degree of interpretation of the original dataset. Every factor has a corresponding variance contribution rate corresponding to the original dataset. It can then be divided by the cumulative variance contribution rate to obtain the weight of each factor, which is also the weight of the corresponding question of that factor. The higher the weight of a factor, the more importance/influence that question has on a specific group of individuals in a specific country, to explain the differences of food choices across groups and countries.

-SEM

The differences between all control groups and test groups were assessed by SEM, as the added-up sample size is large enough for the analysis to produce reliable results. Amos20.0 was used to construct the model for the test groups as well as the control groups. The effect of Q1 to Q4 on all test groups and control groups was studied separately. In the structural model, 34 questions were segmented into four latent variables: Q1 (question 1-11) represents the general app functions and interface. Q2 (questions 12-22) represents the properties and qualities of the canteen food. Q3 (question 23-29) describes the information provided regarding canteen food while Q4 (question 30-34) describes the ethical issues related to food. The paths that link 34 indicator questions (i.e. observable variables) to 4 corresponding factors Q1-Q4 (i.e. latent variables) were then estimated. The initial model based on the hypothetical relationships of the latent variables and the observable variables was then revised several times according to the fit indexes (Schreiber et al., 2006; Hu & Bentler, 1999) and realistic considerations to maximise the model fit in order to compare the consumer preferences between two groups. The reliability (Cronbach's α) and validity (KMO and Bartlett sphericity test) were evaluated before model constructions to judge the suitability of the dataset for the SEM using SPSS 20.0.

*Table. 2 Commonly used fit index*

| Name of the Index | |
|---|---|
| Absolute fit index | $\chi^2$ (chi-square) |
| | GFI |
| | RMSEA |
| Comparative fit | NFI |

| | |
|---|---|
| index | CFI |
| | IFI |
| Information index | AIC |

## RESULTS

The sociodemographic characteristics and health status of the sample population are presented in Table Three below. A total number of 1031 consumers participated in the study across four countries with age ranging from 18 to 61 years. The percentage of the female in all countries are generally higher than that of the male. In Denmark, Greece and the UK, the mean age is around 21 because the study was conducted on campus and most of the participants are from the student communities. In France, the mean age is a lot higher (38.4) because the study was conducted in a company canteen. The educational level in all countries are generally secondary, or university level and most of the participants considered themselves having a Good or above health status. The majority of participants are omnivores, while Denmark has the highest proportion of non-omnivore (i.e. vegetarian, vegan, pescetarian and flexitarian) among four countries. The vegetarian population is also significantly higher in Denmark and UK than France and Greece.

| | *Denmark (n=305)* | *France (n=99)* | *Greece (n=343)* | *United Kingdom (n=284)* |
|---|---|---|---|---|
| *Gender (%)* | Female-63.6<br>Male-36.4 | Female-58.6<br>Male-41.4 | Female-58.9<br>Male-41.1 | Female-61.3<br>Male-38.7 |
| *Age (years)* | 23.49<br>(SD=0.32)<br>(Range 18-55) | 38.4<br>(SD=1.38)<br>(Range 20-61) | 20.47<br>(SD=0.13)<br>(Range 18-36) | 20.36<br>(SD=0.21)<br>(Range 18-46) |
| *Education Level (%)* | Secondary-40.3<br>University-59.7 | Elementary-11.1<br>Secondary-43.4<br>University-45.5 | Elementary-0.9<br>Secondary-88.0<br>University-11.1 | Secondary-60.2<br>University-39.8 |
| *Health Status (%)* | Poor-2.6<br>Fair-15.1<br>Good-53.1<br>Very good-29.2 | Poor-5.1<br>Fair-23.8<br>Good-45.5<br>Very good-21.2 | Poor-1.7<br>Fair-12.0<br>Good-54.5<br>Very good-31.8 | Poor-4.2<br>Fair-19.4<br>Good-52.5<br>Very good-23.9 |
| *Dietary preference(%)* | Omnivore-77.4<br>Vegetarian-6.6<br>Vegan-2.9<br>Pescetarian-4.9<br>Flexitarian-8.2 | Omnivore-87.9<br>Vegetarian-1.0<br>Vegan-2.0<br>Pescetarian-0.0<br>Flexitarian-9.1 | Omnivore-87.8<br>Vegetarian-1.6<br>Vegan-0.0<br>Pescetarian-1.1<br>Flexitarian-9.6 | Omnivore-83.1<br>Vegetarian-5.6<br>Vegan-2.5<br>Pescetarian-4.9<br>Flexitarian-3.9 |

*Table. 3 Sociodemographic information and dietary preference of participants in the study across countries.*

The frequency of canteen usage was captured in the survey with a scale from 1 (lowest usage) to 5 (highest usage). In the survey (Appendix 1 & 2), the frequency for breakfast and a hot meal in the canteen was measured per working week, with scale 1 representing one day or less per week and scale 2 to 5 representing an ascending frequency of usage from 2 days a week to 5 days a week. The frequency for the different beverages and pastry was measured per day, with scale 1 representing rarely or never and scale 2 to 5 representing an ascending frequency from 1 time per day to 4 times per day. The results show that most of the participants only have 1 to 2 breakfasts or hot meals in the canteen per working week and the frequency for daily purchases for beverages and pastry is also very low among all participants (less than 1 time per day).

| | *Denmark (n=305)* | *France (n=99)* | *Greece (n=343)* | *United Kingdom (n=284)* |
|---|---|---|---|---|
| *Breakfast* | 1.30 (SD=0.04) | 1.65 (SD=0.12) | 1.16 (SD=0.04) | 1.30 (SD=0.04) |
| *Hot meal* | 1.76 (SD=0.06) | 1.16 (SD=0.06) | 1.96 (SD=0.10) | 1.62 (SD=0.52) |
| *Coffee & pastry* | 1.71 (SD=0.05) | 1.00 (SD=0.00) | 1.37 (SD=0.05) | 1.79 (SD=0.05) |
| *Sugary beverages* | 1.34 (SD=0.04) | 1.62 (SD=0.07) | 1.10 (SD=0.03) | 1.51 (SD=0.05) |
| *Water & fresh juice* | 1.57 (SD=0.05) | 1.71 (SD=0.07) | 1.60 (SD=0.07) | 1.8 (SD=0.06) |

*Table. 4 The mean of frequency for canteen usage across four countries (scale 1-5)*

## Comparisons across countries and organisational settings

In the results showing the influence of individual factors on consumers' decision making, the higher the weighting of the question, the higher its rank and the more influence it has on consumers' behaviour. For example, the individual factor that is ranked 1 (marked in red colour) means it has the highest weighting and influence among all the factors. The weightings are then ranked and summarised in Table 5 below (full results available in Appendix 3).

### *Denmark (university canteen)*

Most of the top individual factors of the Danish participants in both control and test groups are related to the properties and qualities of the food, such as the safety, freshness, hygiene and sustainability of the canteen food. Ethical issues related to food also concerns Danish consumers hugely. Questions containing information such as animal and human rights, water shortage, sustainability and healthy eating were all ranked 1 in the test group and 2 in the control group. The subtle difference in ranking is possibly due to the change in environment. However, we can observe

from the results that ethical issues are significant to Danish consumer in general. On the other side, confidence and training regarding app usage, information about allergens are the least important factors.

### *France (workplace canteen)*

In the results, there is an interesting shift of the most important factors (rank 1) from the app functions in the control group and interface to the canteen food properties and qualities in the test group that can be explained by various possible causes. Questions regarding app functions and interface such as a system that is simple, easy to use/learn and consistent as well as integrated functions were ranked top in the control group, but 2 in the test group. Meanwhile, questions regarding canteen food qualities and properties such as healthiness, taste, sustainability, hygiene, freshness and personal preference fits were ranked 1 in the test group but ranked 2 to 4 in the control group. Nevertheless, the ranks of the other groups are still relatively consistent, especially regarding app functions and interface. The factors that French consumers have the least concern about are scientific accuracy, personalised information and training for app usage. The information provided regarding canteen food has less influence in general on consumers than other factors.

### *Greece (university canteen)*

Similar to the results in Denmark, the factors that concern Greek participants the most are concentrated in the questions focusing on canteen food qualities and properties. In particular on the healthiness, taste, hygiene, sustainability and freshness. Furthermore, easily understandable information regarding canteen food was also ranked top in both control and test groups. There are some variations in the results comparing both groups. For example, the test group cares more about the accuracy and personalised information as well as the variety and personalised canteen food (rank 1) more than the control group (rank 4-6). The factors that have the least influence varies between two groups. The chef recommendation, discount and app learning have the least impact on the control group while chef recommendations, availability of plant-based dish and integrated app functions have the least impact on the test group.

### *United Kingdom (university canteen)*

The results for the ranking of top factors for UK participants are mostly consistent in both groups, which consists of safety, taste, sustainability, freshness and the variation of food provided. The subtle difference in ranking of easily understandable information is still rather consistent (rank 1 in control group and 2 in test group). However, the test group participants are more aware of the environmentally friendly aspect of the food (rank 1) compare to the control group participants (rank

6). Both groups do not think the confidence of using the app is an essential factor while the control group considered the healthiness of the food and healthy eating lifestyle are the least important factor and the test group considered locally sourced food and global warming the least important factor.

From the aforementioned results from four countries and Table 5 below, we can observe that the consumers in all the countries have a similar trait of valuing the factors related to food quality in the canteen the most, especially food hygiene, sustainability, safety and freshness. However, their preferences in other categories of factors such as the app functions, ethical issues related to food and the information provided in the canteen vary from country to country. In the case of comparing between two organisational settings (i.e. workplace and university canteens), no significant conclusions can be drawn from the current results. The data collection in workplace canteen was only collected in France while the rest of the field tests were conducted in university canteens, due to logistics reasons. Thus, the results from France is the only representation of consumer preferences in the workplace canteen. The sample size for workplace canteen is rather small compared to the rest in order to obtain a reliable comparison.

*Table. 5 Ranking of individual factor's weightings across test and control groups in four countries.*

| Question No. | Acronym | Question | UK Control | UK Test | DK Control | DK Test | GR Control | GR Test | FR Control | FR Test |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | appfreq | I think that I would like to use a system like this frequently | 7 | 5 | 5 | 4 | 3 | 7 | 9 | 2 |
| 2 | appsim | The FoodSMART app system should be simple | 5 | 3 | 6 | 2 | 7 | 2 | 1 | 2 |
| 3 | appeasu | The FoodSMART app system should be easy to use | 5 | 3 | 6 | 2 | 7 | 2 | 1 | 2 |
| 4 | appfunc | The FoodSMART app's functions should be well integrated | 2 | 7 | 3 | 2 | 6 | 8 | 1 | 2 |
| 5 | apptech | I would not want the need of a technical person to be able to use this system | 2 | 6 | 3 | 2 | 1 | 6 | 1 | 2 |
| 6 | appcons | The FoodSMART app system should be consistent | 2 | 3 | 3 | 2 | 6 | 6 | 1 | 2 |
| 7 | appeasl | The FoodSMART app system is easy to learn | 2 | 3 | 3 | 2 | 9 | 7 | 1 | 2 |
| 8 | appmanu | The FoodSMART app system should be wieldy (manageable) to use | 2 | 3 | 3 | 2 | 6 | 2 | 1 | 2 |
| 9 | appconf | I would need to feel confident about using the FoodSMART app for actually using it | 8 | 8 | 8 | 9 | 6 | 2 | 6 | 7 |
| 10 | applearn | I would prefer not to learn a lot of things before I could get going with the FoodSMART | 2 | 2 | 8 | 7 | 9 | 2 | 7 | 8 |
| 11 | appuse | I believe the FoodSMART App will be useful to customers in a canteen setting to help them to get informed about dishes offered | 7 | 7 | 6 | 4 | 3 | 7 | 4 | 4 |
| 12 | fsafe | It is important for me that the food provided by the canteen is safe | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 |
| 13 | fhealthy | It is important for me that the food provided by the canteen is healthy | 8 | 5 | 9 | 5 | 1 | 1 | 2 | 1 |
| 14 | ftasty | It is important for me that the food provided by the canteen is tasty | 1 | 1 | 1 | 4 | 1 | 1 | 4 | 1 |
| 15 | fenvfr | It is important for me that the food provided by the canteen is environmentally friendly | 6 | 1 | 2 | 1 | 5 | 1 | 3 | 1 |
| 16 | fhygie | It is important for me that the food provided by the canteen is prepared with care for hygiene | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| 17 | fsust | It is important for me that the food provided by the canteen is sustainable | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 1 |
| 18 | ffresh | It is important for me that the food provided by the canteen is fresh | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| 19 | flocal | It is important for me that the food provided by the canteen is locally sourced/produced | 4 | 8 | 4 | 6 | 5 | 6 | 3 | 1 |
| 20 | fpersneed | It is important for me that the food provided by the canteen responds to my personal needs and preferences | 4 | 1 | 4 | 8 | 4 | 1 | 4 | 1 |
| 21 | pdish | It is important for me that the canteen provides at least one plant-based dish option | 4 | 2 | 4 | 1 | 5 | 10 | 4 | 4 |
| 22 | fvaried | It is important for me that the food provided by the canteen is varied | 1 | 1 | 1 | 3 | 4 | 1 | 7 | 4 |
| 23 | infacc | It is important for me that the information provided by the canteen is scientifically accurate | 4 | 2 | 4 | 9 | 6 | 1 | 8 | 5 |
| 24 | infpers | It is important for me that the information provided by the canteen is personalised to my needs | 4 | 2 | 4 | 3 | 4 | 1 | 9 | 5 |
| 25 | infeasyunc | It is important for me that the information provided by the canteen is easy to understand | 1 | 2 | 1 | 3 | 1 | 1 | 8 | 5 |
| 26 | infchefrec | It is important for me that the canteen informs me about the day's or chef's recommendations | 7 | 2 | 5 | 3 | 8 | 9 | 5 | 5 |
| 27 | infdisc | It is important for me that the canteen informs me about special offers and discounts | 7 | 2 | 5 | 7 | 8 | 4 | 5 | 5 |
| 28 | infcalor | It is important for me that the canteen informs me about the calories in the dishes | 6 | 2 | 5 | 2 | 3 | 4 | 5 | 6 |
| 29 | infallerg | It is important for me that the canteen informs me about allergens | 6 | 2 | 7 | 10 | 5 | 5 | 5 | 3 |
| 30 | genhealea | I am usually concerned about health and healthy eating | 8 | 5 | 2 | 1 | 2 | 1 | 2 | 3 |
| 31 | genenv | I am usually concerned about global warming and sustainability | 3 | 9 | 2 | 1 | 2 | 3 | 6 | 3 |
| 32 | genanright | I am usually concerned about animal rights | 3 | 4 | 2 | 1 | 2 | 3 | 3 | 3 |
| 33 | genhumrig | I am usually concerned about human rights | 3 | 4 | 2 | 1 | 2 | 3 | 6 | 3 |
| 34 | genwsh | I am usually concerned about water shortages | 3 | 4 | 2 | 1 | 2 | 3 | 6 | 6 |

## Comparisons between control and test groups (Data mining)

Two models for factors that influence consumer food choices in the canteen were constructed to mine the data collected and explore the relationships and intensity of those relationships between factors.

*Evaluation of model reliability and validity*

The Cronbach's α coefficient which indicates the stability and internal consistency was used to evaluate the reliability of the models. The higher the reliability coefficient of the scale, the greater the correlation between the items and the smaller the standard error of measurement (Hatcher, 1994). The reliability is good and desirable when the Cronbach's α coefficient is >0.8. The range between 0.7 and 0.8 is acceptable while the range between 0.6 and 0.7 is questionable but still acceptable. A Cronbach's α below 0.6 is considered weak and below 0.5 is unacceptable (Nunnally, 1978). The Cronbach's α of all the latent variables were in the acceptable or desirable range, which confirms the reliability of the model (Table. 6).

| Latent variables | Number of items (observable variables) | Cronbach's α (Control group) | Cronbach's α (Test group) |
|---|---|---|---|
| Q1 | 11 | 0.802 | 0.761 |
| Q2 | 11 | 0.811 | 0.879 |
| Q3 | 7 | 0.758 | 0.765 |
| Q4 | 5 | 0.774 | 0.688 |

*Table. 6 Reliability test results (Cronbach's α coefficient)*

The overall validity was evaluated by the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test. KMO measures the sampling adequacy. The KMO value closer to 1 the better while 0.6 is suggested as the minimum requirement. The Bartlett's test is for the null hypothesis that the correlation matrix has an identity matrix. A value of less than 0.05 is considered at the significant level (Kim, 2008).

| | KMO of Sampling Adequacy | Bartlett's Test of Sphericity | | |
|---|---|---|---|---|
| | | Approx. Chi-square | DF (Degree of Freedom) | Significance |
| Control group sample | 0.863 | 7667.343 | 561 | 0.000 |
| Test group sample | 0.862 | 5994.857 | 561 | 0.000 |

*Table.7 KMO-Bartlett's test results*

The overall KMO values are > 0.7, indicating good adequacy while Bartlett's test shows a P-value < 0.05, meaning the dataset is fit for the modelling.

*SEM*

After evaluating the model reliability and adequacy, models for both control and test groups were constructed. The paths were estimated based on 34 indicator questions (i.e. observable variables) to 4 corresponding factors Q1-Q4 (i.e. latent variables):

- Q1 (question 1-11)-the general app functions and interface.
- Q2 (questions 12-22)-properties and qualities of the canteen food.
- Q3 (question 23-29)-information provided regarding canteen food.
- Q4 (question 30-34)-the ethical issues related to food.

When the initial model is obtained, the validity of the model can be judged by the fit index (see method), and the standard can be appropriately relaxed according to the actual situations. However, the evaluation of this indicator is not the only evaluation of the model, and it is necessary to pay attention to the rational interpretation of the indicators. The final model is obtained (Fig.1 & Fig.2) after meeting the theoretical or acceptable ranges of the fit index (Sivo et al., 2006) and adjustments of correlated paths (full analysis available in Appendix 4).

*-Control group model*

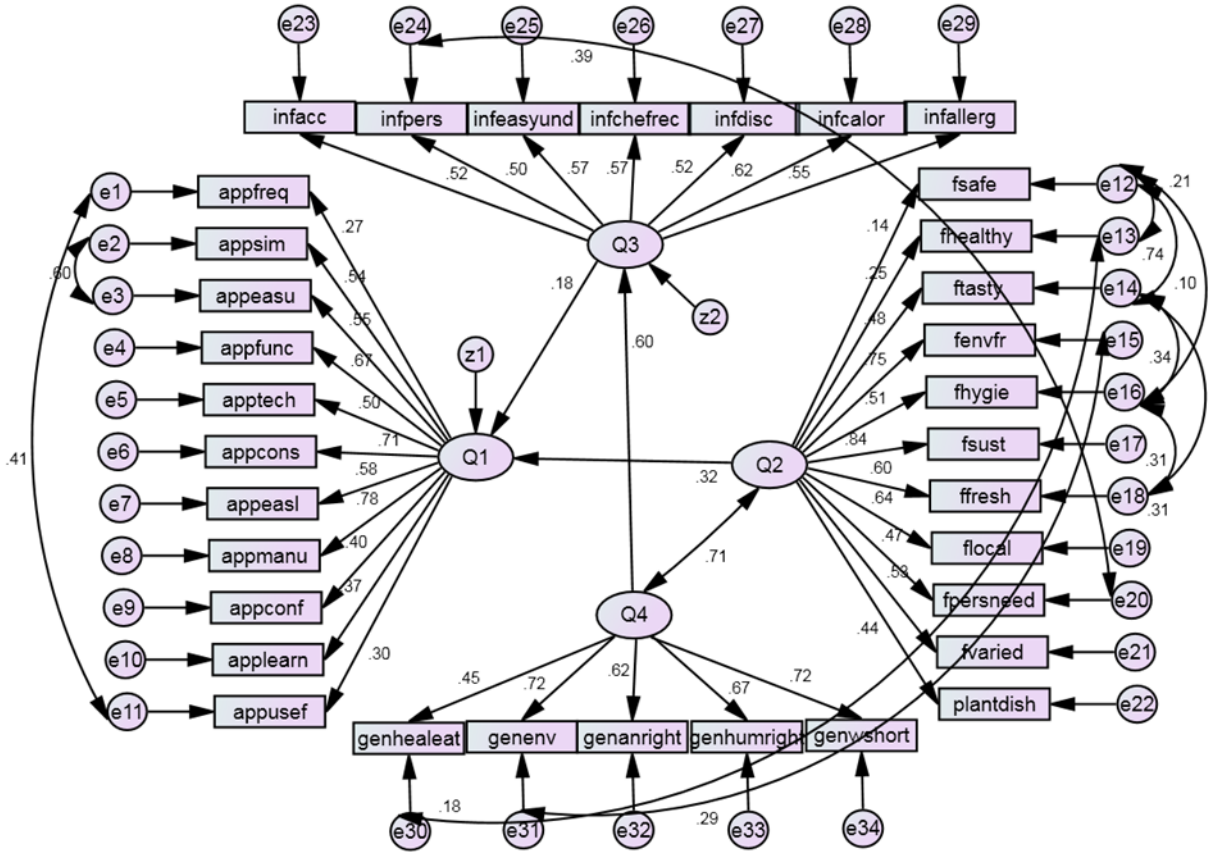



*Fig.1 The final SEM path diagram of the control group.*

| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Final model | 2.689 | 0.066 | 0.847 | 0.761 | 0.801 | 0.821 | 0.072 | 2197.581 |
| Theoretical Range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller, the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller, the better |

*Table. 8 Fit index of the final model of the control group*

*-Test group model*

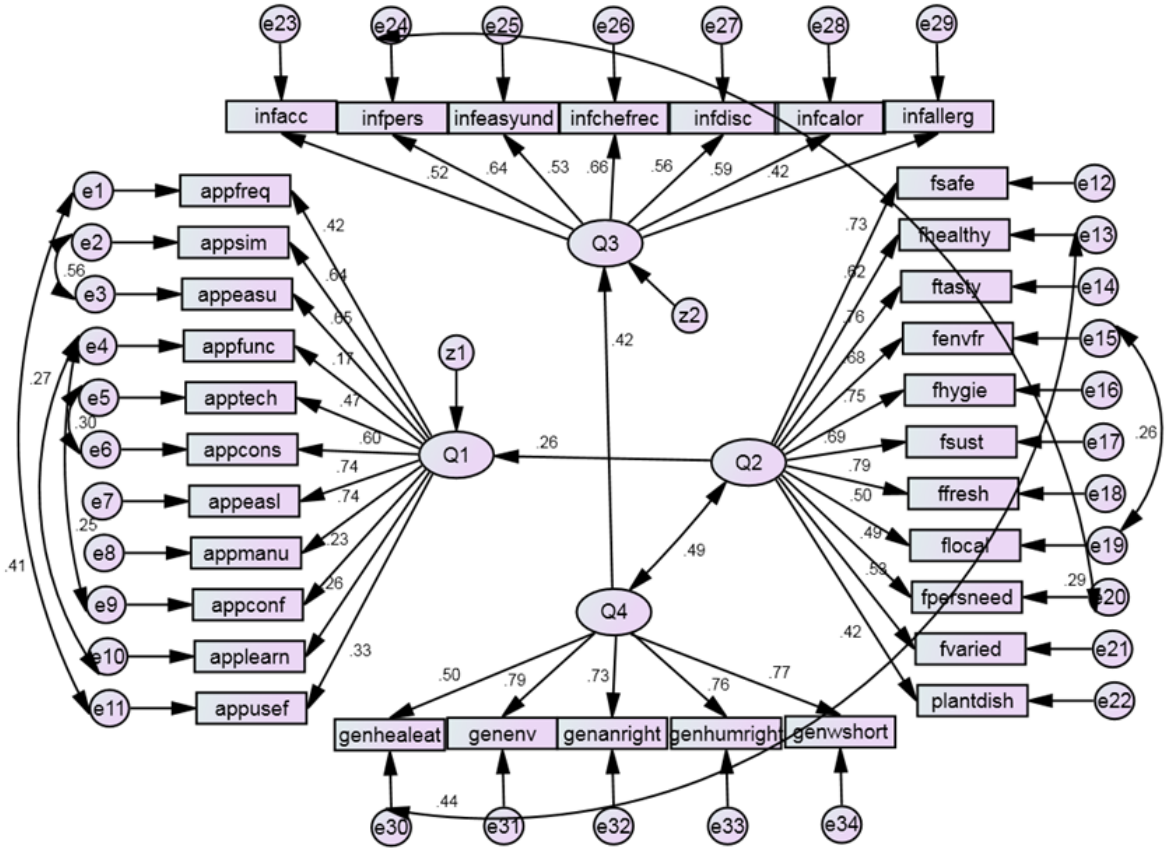



*Fig.1 The final SEM path diagram of the test group*

| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Final model | 2.775 | 0.066 | 0.843 | 0.783 | 0.849 | 0.848 | 0.066 | 1693.271 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller, the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller, the better |

*Table. 9 Fit index of the final model of the test group*

Significant positive correlations can be observed among the corresponding factors (Q1 to Q4). The Pearson product-moment correlation coefficients (PCCs) of the four dimensions are smaller than 0.7 that means there is no influence from collinearity. Thus, there was no increase in the approx. Chi-Square value, or appearance of negative variance or unreasonable estimates. From both models, most of the indicator questions are significantly positively correlated with the corresponding factors, and the intensity of the correlation varies from indicator to indicator. The higher the value of the coefficient, the stronger the correlations, which also means that the indicator has a greater influence on the corresponding factors. For example, regarding the app functions and interface (Q1), the highest coefficient is found with the app should be mangeable to use (appmanu) in both control and

test groups. This means this specific indicator regarding app learning is the most critical factor for the app function and interface within the population surveyed.

The top indicator for app functions and interface (Q1) in the control group model is that the app should be manageable to use (0.78) while that of the test group is the app should be manageable to use (0.74) and easy to use (0.74). For canteen food qualities and properties (Q2) in the control group, the top indicator is that the canteen food is sustainable (0.84) while that of the test group is that the canteen food should be fresh (0.79). Meanwhile, the coefficients for food sustainability in the test group and food freshness in the control group are also high, 0.69 and 0.60 respectively. The top indicator for information provided in the canteen (Q3) of the control group is calorie information (0.62) while that of the test group is chef recommendation (0.66). The rest of the indicators in that group can be relatively equally influential, since the value of coefficients all fall into the 0.5-0.7 range, except that of allergy information in the test group (0.42). Lastly, the indicator with the highest value of the coefficient of food-related ethical issues (Q4) is global warming and sustainability for both control and test groups (0.72 & 0.79).

## Discussion

In this report, consumer food choice across countries and organisational settings were interpreted and evaluated through data mining and related measured/analytical approaches. 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. 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, and global warming/sustainability issues have the highest value of the coefficient in respect to their corresponding factors. This provides direction of prioritisation when addressing specific issues in relation to the aforementioned four factors and more common understandings of consumer food choice as a whole (across four countries).

On the other hand, findings regarding comparisons of consumer food choice among countries show that consumers share the similar trait of valuing canteen food quality the most, especially for food sustainability, freshness, hygiene and safety. The consumer preferences for the rest of the factor vary from country to country. No significant conclusions can be drawn regarding differences and similarities in two organisational settings (workplace and university canteen) from the results due to

the small amount of data collected in the workplace canteen. Further study can be performed to produce more inputs of consumer food choice in the workplace canteen and other organisational settings. Information regarding the key stages of food preparation was not captured via the app and the questionnaire due to logistic reasons. Future investigations can be done to follow the key stages for food preparation in the canteen via either the app or questionnaire.

Apart from the main findings, the reason for inconsistency in results of the French population among four countries and between the two groups could be that French participants have reported having trouble understanding the app introduction video used during the control situation due to language barriers, which in turn might cause difficulties in understanding the app functions and interface. Compared to the control group; the test group participants used the app after watching the introduction video. This change in experience could be the potential reason for the shift of attention from the app to the canteen food. However, the results from the opposite group still had relatively consistent results (e.g. the questions ranked 1 in the control group were all ranked 2 in the test group). This is possible because that even after using the app in real-life, the language barrier still exists as the app interface is in the English language. Participants in the French test group still experienced difficulties in navigating the app in English. Moreover, the sample size of France (n=99) is lower than the targeted sample size (100 observations for each group), and results are less consistent in a smaller population, and hard to determine the real reasons behind the change in attitudes. Further investigations (i.e. obtain a larger sample) are needed to explain this phenomenon. Another limitation of the study is the application used during the field tests were all tablets, which could not truly reflect the consumers' responses using other applications (e.g. smartphone).

## CONCLUSIONS

The study successfully interprets and evaluates consumer food choice across countries (Denmark, France, Greece and UK) via data mining and other related measured/analytical approaches. Specific indicators can be targeted when addressing issues related to app functions, food quality, information provision and food-related ethical issues during ICT development for dietary behaviour change. The consumer insights obtained from the study can be utilised for the guidance of commercialisation and future research directions.

## REFERENCES

Bohm E. and Quartuccio N. 2008. Healthy dining restaurant nutrition program – a winning recipe for consumers, dietitians and restaurants. Journal of the American Dietetic Association, 108, A-112.

Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M.R. and Christensen, H., 2013. Smartphones for smarter delivery of mental health programs: a systematic review. Journal of medical Internet research, 15(11), p.e247.

Ehrenreich, B., Righter, B., Rocke, D.A., Dixon, L. and Himelhoch, S., 2011. Are mobile phones and handheld computers being used to enhance delivery of psychiatric treatment?: a systematic review. The Journal of nervous and mental disease, 199(11), pp.886-891.

Hatcher, Larry. 1994. A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling (SAS Publishing).

Hu, Li-tze, and Peter M Bentler. 1999. Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives.

Kim, Hee-Ju. 2008. 'Common Factor Analysis Versus Principal Component Analysis: Choice for Symptom Cluster Research', Asian Nursing Research, 2: 17-24.

Lowe, B., de Souza-Monteiro, D. M. and Fraser, I. (2013), "Nutritional Labelling Information: Utilisation of New Technologies", Journal of Marketing Management, Vol. 9 No. 11/12, pp. 1337-1366.

Muessig, K.E., Nekkanti, M., Bauermeister, J., Bull, S. and Hightow-Weidman, L.B., 2015. A systematic review of recent smartphone, Internet and Web 2.0 interventions to address the HIV continuum of care. Current HIV/AIDS Reports, 12(1), pp.173-190.

Nunnally, J.C. 1978. Psychometric theory (McGraw-Hill).

Murray, E., 2012. Web-based interventions for behavior change and self-management: potential, pitfalls, and progress. Medicine 2.0, 1(2), p.e3.

Ofcom, 2015. Communications Market Report. London: Ofcom.

Schreiber, James, Amaury Nora, Frances Stage, Elizabeth A. Barlow, and Jamie King. 2006. Reporting Structural Equation Modeling and Confirmatory Factor Analysis Results: A Review.

Sivo, Stephen A., Xitao Fan, E. Lea Witta, and John T. Willse. 2006. 'The Search for "Optimal" Cutoff Properties: Fit Index Criteria in Structural Equation Modeling', The Journal of Experimental Education, 74: 267-88.

Webb, T., Joseph, J., Yardley, L. and Michie, S., 2010. Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. Journal of medical Internet research, 12(1), p.e4.

# Appendix 1

**Questionnaire for Control Groups**

Dear participant,

We would be grateful if you could set your thoughts down on this form.

This study aims to critically assess consumer evaluation of the FoodSMART app. FoodSMART is an application to bridge between the consumer and the foodservice operators responsible for this canteen. It will allow you to introduce your own preferences for foods and information, and it will provide you with the dishes matching more closely your stated preferences.

If you want more information about FoodSMART, please watch the video at https://youtu.be/roLlNbLvJMA

Your contribution to better understand consumer response and use of this app will help us to improve it, and eventually provide a better-targeted system for consumers.

Any answers you give will be kept strictly confidential.

Thank you for your time and help and valuable ideas.


**Please provide your level of agreement or disagreement with the following statements before having used the FoodSMART app**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| I think that I would like to use a system like this frequently | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be simple | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be easy to use | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app's | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| functions should be well integrated | | | | | |
| I would not want the need of a technical person to be able to use this system | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be consistent | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system is easy to learn | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be wieldy (manageable) to use | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I would need to feel confident about using the FoodSMART app for actually using it | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I would prefer not to learn a lot of things before I could get going with the FoodSMART app | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I believe the FoodSMART App will be useful to customers in a canteen setting to help them to get informed about dishes offered | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

## Please mark the box that corresponds to you

(1) ❑ I am a female

(2) ❑ I am a male

Please write your age in years

___

Please provide us with your highest educational achievement (mark the box corresponding to you)

(1) ❑ Elementary School

(2) ❑ Secondary School

(3) ❑ University degree

I think that my health is (mark the box corresponding to you)

(1) ❑ Poor

(2) ❑ Fair

(3) ❑ Good

(4) ❑ Very Good

On a normal working week (mark the box corresponding to you)

| | Once a week or less | Two days in the week | Three days in the week | Four days in the week | Five days in the week |
|---|---|---|---|---|---|
| How frequently do you use the canteen to buy your breakfast? | (1) ❑ | (3) ❑ | (2) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen to buy a hot meal? | (1) ❑ | (3) ❑ | (2) ❑ | (4) ❑ | (5) ❑ |

On a normal working week (mark the box corresponding to you)

| | Rarely or never | Once a day or less | Two times in the day | Three times in the day | Four times in the day |
|---|---|---|---|---|---|
| How frequently do you use the canteen for a coffee + pastry/cake/cookie | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen for a sugary sweetened beverage | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen for acquiring drinking water or fresh pressed juice | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

Please provide your level of agreement or disagreement with the following statements (mark the box corresponding to your answer)

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the food provided by the canteen is safe | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is healthy | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is tasty | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| environmentally friendly | | | | | |
| It is important for me that the food provided by the canteen is prepared with care for hygiene | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is sustainable | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is fresh | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is locally sourced/produced | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen responds to my personal needs and preferences | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen provides at least one plant-based dish option | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is varied | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Please provide your level of agreement or disagreement with the following statements about your needs for information from the canteen (mark the box corresponding to your answer)**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the information provided by the canteen is scientifically accurate | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the information provided by the canteen is personalised to my needs | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the information provided by the canteen is easy to understand | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about the day's or chef's recommendations | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about special offers and discounts | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about the calories in the dishes | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about allergens | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Please provide your level of agreement or disagreement with the following statements about your general concerns (mark the box corresponding to your answer)**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| I am usually concerned about health and healthy eating | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about global warming and sustainability | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about animal rights | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about human rights | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about water shortages | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Lastly, could you please let us know how do you see yourself as food consumer?**

(1) ❑ I am omnivore (I eat everything)

(2) ❑ I am vegetarian (I eat plant-based and include eggs and dairy in my food)

(3) ❑ I am vegan (I eat only plant-based foods and avoid any animal products)

(4) ❑ I am pescetarian (I eat plant-based like vegetarians and include fish)

(5) ❑ I am flexitarian (I eat mostly plant-based foods, but occasionally I would eat foods of animal origin)

Thank you very much for your participation! Your are contributing to the provision of better information to consumers.


## Appendix 2

**Questionnaire for Test Groups**

Dear participant,

We would be grateful if you could set your thoughts down on this form.

You have used the FoodSMART app today, and we would like to hear your opinion about the system and whether we can make improvements.

The aim of this study is to critically assess consumer evaluation of the FoodSMART app. Your contribution to better understand consumer response and use of this app will help us to improve it, and eventually provide a better targeted system for consumers.

Any answers you give will be kept strictly confidential.

Thank you for your time and help and valuable ideas.


**Could you please let us know in which canteen are you located?**

(1) ❑ UK - Bournemouth University

(2) ❑ DK - Copenhagen University

(3) ❑ AU- Austria

(4) ❑ HE - Greece

**Please provide your level of agreement or disagreement with the following statements before having used the FoodSMART app**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| I think that I would like to use a system like this frequently | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be simple | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be easy to use | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app's | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| functions should be well integrated | | | | | |
| I would not want the need of a technical person to be able to use this system | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be consistent | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system is easy to learn | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| The FoodSMART app system should be wieldy (manageable) to use | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I would need to feel confident about using the FoodSMART app for actually using it | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I would prefer not to learn a lot of things before I could get going with the FoodSMART app | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I believe the FoodSMART App will be useful to customers in a canteen setting to help them to get informed about dishes offered | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

Please mark the box that corresponds to you

(1) ❑ I am a female

(2) ❑ I am a male

Please write your age in years

___

Please provide us with your highest educational achievement (mark the box corresponding to you)

(1) ❑ Elementary School

(2) ❑ Secondary School

(3) ❑ University degree

What is your country of residence?

(1) ❑ Denmark

(2) ❑ France

(3) ❑ Austria

(4) ❑ Greece

I think that my health is (mark the box corresponding to you)

(1) ❑ Poor

(2) ❑ Fair

(3) ❑ Good

(4) ❑ Very Good

## On a normal working week (mark the box corresponding to you)

| | Once a week or less | Two days in the week | Three days in the week | Four days in the week | Five days in the week |
|---|---|---|---|---|---|
| How frequently do you use the canteen to buy your breakfast? | (1) ❑ | (3) ❑ | (2) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen to buy a hot meal? | (1) ❑ | (3) ❑ | (2) ❑ | (4) ❑ | (5) ❑ |

## On a normal working week (mark the box corresponding to you)

| | Rarely or never | Once a day or less | Two times in the day | Three times in the day | Four times in the day |
|---|---|---|---|---|---|
| How frequently do you use the canteen for a coffee + pastry/cake/cookie | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen for a sugary sweetened beverage | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| How frequently do you use the canteen for acquiring drinking water or fresh pressed juice | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

Please provide your level of agreement or disagreement with the following statements (mark the box corresponding to your answer)

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the food provided by the canteen is safe | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is healthy | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is tasty | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is environmentally friendly | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is prepared with care for hygiene | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is sustainable | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is fresh | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is locally sourced/produced | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the food provided by the canteen responds to my personal needs and preferences | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen provides at least one plant-based dish option | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the food provided by the canteen is varied | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Please provide your level of agreement or disagreement with the following statements about your needs for information from the canteen (mark the box corresponding to your answer)**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the information provided by the canteen is scientifically accurate | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the information provided by the canteen is personalised to my needs | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the information provided by the canteen is easy to understand | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| It is important for me that the canteen informs me about the day's or chef's recommendations | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about special offers and discounts | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about the calories in the dishes | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| It is important for me that the canteen informs me about allergens | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Please provide your level of agreement or disagreement with the following statements about your general concerns (mark the box corresponding to your answer)**

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| I am usually concerned about health and healthy eating | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about global warming and sustainability | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about animal rights | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |
| I am usually concerned about | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

| | Strongly disagree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
|---|---|---|---|---|---|
| human rights | | | | | |
| I am usually concerned about water shortages | (1) ❑ | (2) ❑ | (3) ❑ | (4) ❑ | (5) ❑ |

**Lastly, could you please let us know how do you see yourself as food consumer?**

(1) ❑ I am omnivore (I eat everything)

(2) ❑ I am vegetarian (I eat plant-based and include eggs and dairy in my food)

(3) ❑ I am vegan (I eat only plant-based foods and avoid any animal products)

(4) ❑ I am pescetarian (I eat plant-based like vegetarians and include fish)

(5) ❑ I am flexitarian (I eat mostly plant-based foods, but occasionally I would eat foods of animal origin)

(1) ❑ Extremely Dissatisfied

(2) ❑ Moderately Dissatisfied

(3) ❑ Slightly Dissatisfied

(4) ❑ Neutral

(5) ❑ Slightly Satisfied

(6) ❑ Moderately Satisfied

(7) ❑ Extremely Satisfied

Thank you very much for your participation! Your are contributing to the provision of better information to consumers.


# Appendix 3

**PCA (Full Results)**

DK CONTROL

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Square Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 8.896 | 26.164 | 26.164 | 8.896 | 26.164 | 26.164 | 3.808 | 11.200 | 11.200 |
| 2 | 3.325 | 9.779 | 35.943 | 3.325 | 9.779 | 35.943 | 3.422 | 10.064 | 21.265 |
| 3 | 2.293 | 6.743 | 42.686 | 2.293 | 6.743 | 42.686 | 3.286 | 9.664 | 30.929 |
| 4 | 1.963 | 5.775 | 48.461 | 1.963 | 5.775 | 48.461 | 2.794 | 8.217 | 39.146 |
| 5 | 1.549 | 4.557 | 53.018 | 1.549 | 4.557 | 53.018 | 2.513 | 7.391 | 46.536 |
| 6 | 1.275 | 3.751 | 56.769 | 1.275 | 3.751 | 56.769 | 2.007 | 5.904 | 52.440 |
| 7 | 1.207 | 3.551 | 60.320 | 1.207 | 3.551 | 60.320 | 1.695 | 4.985 | 57.425 |
| 8 | 1.060 | 3.116 | 63.436 | 1.060 | 3.116 | 63.436 | 1.543 | 4.539 | 61.964 |
| 9 | 1.001 | 2.945 | 66.381 | 1.001 | 2.945 | 66.381 | 1.502 | 4.417 | 66.381 |
| 10 | .940 | 2.764 | 69.145 | | | | | | |
| 11 | .786 | 2.310 | 71.455 | | | | | | |
| 12 | .732 | 2.152 | 73.607 | | | | | | |
| 13 | .714 | 2.101 | 75.707 | | | | | | |
| 14 | .657 | 1.933 | 77.641 | | | | | | |
| 15 | .639 | 1.878 | 79.519 | | | | | | |
| 16 | .597 | 1.757 | 81.276 | | | | | | |
| 17 | .587 | 1.727 | 83.003 | | | | | | |
| 18 | .545 | 1.603 | 84.606 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 19 | .499 | 1.467 | 86.072 | | | | | | |
| 20 | .486 | 1.429 | 87.502 | | | | | | |
| 21 | .476 | 1.400 | 88.902 | | | | | | |
| 22 | .410 | 1.207 | 90.109 | | | | | | |
| 23 | .409 | 1.203 | 91.312 | | | | | | |
| 24 | .361 | 1.061 | 92.374 | | | | | | |
| 25 | .346 | 1.017 | 93.390 | | | | | | |
| 26 | .332 | .976 | 94.367 | | | | | | |
| 27 | .299 | .880 | 95.246 | | | | | | |
| 28 | .290 | .853 | 96.100 | | | | | | |
| 29 | .269 | .790 | 96.890 | | | | | | |
| 30 | .254 | .748 | 97.637 | | | | | | |
| 31 | .229 | .673 | 98.311 | | | | | | |
| 32 | .213 | .627 | 98.937 | | | | | | |
| 33 | .186 | .547 | 99.484 | | | | | | |
| 34 | .175 | .516 | 100.000 | | | | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | | | | | .505 | .486 | | | |
| 2 | | | .368 | | | .750 | | | |
| 3 | | | .416 | | | .687 | | | |
| 4 | | | .735 | | | .277 | | | |
| 5 | | | .756 | | | | | | |
| 6 | | | .839 | | | | | | |
| 7 | | | .520 | | | | | .455 | |
| 8 | | | .721 | | | .281 | | | |
| 9 | | | | | | | | .793 | |
| 10 | .288 | | .346 | .254 | | | | .489 | -.305 |
| 11 | .325 | | | | .452 | .474 | | .254 | |
| 12 | .726 | | | | | | | | |
| 13 | .357 | | | .383 | | | | | .568 |
| 14 | .784 | | | | | | | | |
| 15 | | .546 | | .285 | | | .447 | | |
| 16 | .791 | | | | | | | | |
| 17 | .355 | .488 | | .347 | | | .427 | | |
| 18 | .630 | | | | | | .279 | | |
| 19 | | .440 | | .567 | | | | | |
| 20 | .298 | | | .709 | | | | | .267 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 21 | | | | .615 | | | .440 | | |
| 22 | .614 | | | .306 | | | | | |
| 23 | .302 | | | .488 | | | .272 | -.263 | |
| 24 | | | | .703 | .388 | | | | |
| 25 | .464 | | | .318 | | .269 | .288 | | |
| 26 | | | | | .746 | | | | |
| 27 | .253 | | | | .686 | | | | |
| 28 | | | | | .659 | | .345 | | .267 |
| 29 | .274 | | | | .288 | | .733 | | |
| 30 | | | | | | | | | .830 |
| 31 | | .821 | | | | | | | |
| 32 | | .750 | | | | | | | |
| 33 | | .654 | | | | | | | |
| 34 | | .799 | | | | | | | |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a. Rotation converged in 9 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 12\14\16\18\22\25 | 11.2 | 11.2 | 0.168723 |
| 2 | 15\17\31\32\33\34 | 10.064 | 21.265 | 0.15161 |
| 3 | 4\5\6\7\8 | 9.664 | 30.929 | 0.145584 |
| 4 | 19\20\21\23\24 | 8.217 | 39.146 | 0.123785 |
| 5 | 1\26\27\28 | 7.391 | 46.536 | 0.111342 |
| 6 | 2\3\11 | 5.904 | 52.44 | 0.088941 |
| 7 | 29 | 4.985 | 57.425 | 0.075097 |
| 8 | 9\10 | 4.539 | 61.964 | 0.068378 |
| 9 | 13/30 | 4.417 | 66.381 | 0.06654 |

DK TEST

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 6.324 | 18.601 | 18.601 | 6.324 | 18.601 | 18.601 |
| 2 | 4.371 | 12.855 | 31.456 | 4.371 | 12.855 | 31.456 |
| 3 | 2.920 | 8.590 | 40.046 | 2.920 | 8.590 | 40.046 |
| 4 | 2.237 | 6.581 | 46.626 | 2.237 | 6.581 | 46.626 |
| 5 | 1.618 | 4.758 | 51.384 | 1.618 | 4.758 | 51.384 |
| 6 | 1.572 | 4.624 | 56.008 | 1.572 | 4.624 | 56.008 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | 1.276 | 3.753 | 59.761 | 1.276 | 3.753 | 59.761 |
| 8 | 1.146 | 3.369 | 63.130 | 1.146 | 3.369 | 63.130 |
| 9 | 1.042 | 3.064 | 66.194 | 1.042 | 3.064 | 66.194 |
| 10 | 1.028 | 3.023 | 69.217 | 1.028 | 3.023 | 69.217 |
| 11 | .895 | 2.631 | 71.848 | | | |
| 12 | .861 | 2.533 | 74.381 | | | |
| 13 | .816 | 2.401 | 76.782 | | | |
| 14 | .753 | 2.216 | 78.998 | | | |
| 15 | .700 | 2.059 | 81.056 | | | |
| 16 | .623 | 1.831 | 82.888 | | | |
| 17 | .581 | 1.709 | 84.597 | | | |
| 18 | .571 | 1.680 | 86.276 | | | |
| 19 | .535 | 1.574 | 87.851 | | | |
| 20 | .496 | 1.458 | 89.309 | | | |
| 21 | .431 | 1.267 | 90.576 | | | |
| 22 | .408 | 1.200 | 91.776 | | | |
| 23 | .384 | 1.129 | 92.905 | | | |
| 24 | .344 | 1.011 | 93.916 | | | |
| 25 | .339 | .996 | 94.912 | | | |
| 26 | .288 | .848 | 95.761 | | | |
| 27 | .268 | .789 | 96.550 | | | |
| 28 | .238 | .700 | 97.250 | | | |
| 29 | .216 | .635 | 97.885 | | | |
| 30 | .206 | .606 | 98.490 | | | |
| 31 | .158 | .466 | 98.956 | | | |
| 32 | .147 | .432 | 99.388 | | | |
| 33 | .112 | .330 | 99.718 | | | |
| 34 | .096 | .282 | 100.000 | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | .268 | | .266 | .562 | | | -.369 | | | -.304 |
| 2 | .327 | .643 | | | | | .275 | | | |
| 3 | .333 | .719 | | | | | | | | |
| 4 | .285 | .706 | | | | | | | -.328 | |
| 5 | | .470 | | | -.373 | | | | | -.363 |
| 6 | .266 | .721 | | .323 | | | | | | |
| 7 | .268 | .366 | .250 | .318 | | -.289 | | -.332 | | |
| 8 | .256 | .681 | | .322 | .268 | | | | | |
| 9 | | .283 | | | .325 | | .323 | .380 | .393 | .365 |
| 10 | | | | | -.255 | .429 | .493 | | | |
| 11 | .252 | | | .569 | .398 | | | | .270 | |
| 12 | .471 | .259 | | -.440 | | .312 | | | | |
| 13 | .380 | | .260 | -.327 | .514 | .279 | .275 | | | |
| 14 | .407 | | .306 | -.535 | | | | | | |
| 15 | .652 | -.345 | -.270 | | | | | | | |
| 16 | .401 | .291 | | | | | -.505 | | | |
| 17 | .629 | | -.409 | | | | | | | |
| 18 | .530 | | .278 | -.377 | | | | | | |
| 19 | .496 | | | | | -.516 | | | | |
| 20 | .413 | | .319 | | | -.389 | | .410 | | |
| 21 | .574 | -.259 | | | | | | -.309 | | |
| 22 | .471 | | .464 | | | | | | | |
| 23 | .425 | | | .279 | -.330 | | | .324 | -.380 | |
| 24 | .333 | -.445 | .506 | | | | | .280 | | |
| 25 | .507 | | .527 | | | | | | | |
| 26 | .305 | -.375 | .474 | .286 | | | | -.320 | | |
| 27 | .385 | | .433 | | -.544 | | | | | |
| 28 | | -.525 | .391 | .254 | | .301 | | | | |
| 29 | | | | | | .494 | -.362 | | | .420 |
| 30 | .568 | -.302 | | | | | | | | |
| 31 | .639 | | -.429 | | | | | | | |
| 32 | .631 | | -.460 | | | | | | | |
| 33 | .630 | | -.499 | | | | | | | |
| 34 | .700 | | -.276 | | | | | | | .255 |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a.Rotation converged in 10 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 12\15\17\18\21\30\31\32\33\34 | 18.601 | 18.601 | 0.268735 |
| 2 | 2\3\4\5\6\7\8\28 | 12.855 | 31.456 | 0.18572 |
| 3 | 22\24\25\26 | 8.59 | 40.046 | 0.124102 |
| 4 | 1\11\14 | 6.581 | 46.626 | 0.095078 |
| 5 | 13\27 | 4.758 | 51.384 | 0.06874 |
| 6 | 19 | 4.624 | 56.008 | 0.066804 |
| 7 | 10\16 | 3.753 | 59.761 | 0.054221 |
| 8 | 20 | 3.369 | 63.13 | 0.048673 |
| 9 | 9\23 | 3.064 | 66.194 | 0.044267 |
| 10 | 29 | 3.023 | 69.217 | 0.043674 |

GR CONTROL

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Square Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 7.731 | 22.738 | 22.738 | 7.731 | 22.738 | 22.738 | 3.720 | 10.941 | 10.941 |
| 2 | 2.744 | 8.069 | 30.808 | 2.744 | 8.069 | 30.808 | 2.714 | 7.984 | 18.925 |
| 3 | 2.329 | 6.851 | 37.659 | 2.329 | 6.851 | 37.659 | 2.584 | 7.599 | 26.524 |
| 4 | 1.891 | 5.562 | 43.220 | 1.891 | 5.562 | 43.220 | 2.467 | 7.257 | 33.780 |
| 5 | 1.502 | 4.417 | 47.637 | 1.502 | 4.417 | 47.637 | 2.146 | 6.312 | 40.093 |
| 6 | 1.425 | 4.191 | 51.829 | 1.425 | 4.191 | 51.829 | 2.069 | 6.085 | 46.178 |
| 7 | 1.269 | 3.732 | 55.560 | 1.269 | 3.732 | 55.560 | 2.055 | 6.045 | 52.223 |
| 8 | 1.161 | 3.413 | 58.974 | 1.161 | 3.413 | 58.974 | 1.868 | 5.495 | 57.718 |
| 9 | 1.131 | 3.325 | 62.299 | 1.131 | 3.325 | 62.299 | 1.558 | 4.581 | 62.299 |
| 10 | .976 | 2.871 | 65.170 | | | | | | |
| 11 | .901 | 2.651 | 67.821 | | | | | | |
| 12 | .867 | 2.551 | 70.371 | | | | | | |
| 13 | .828 | 2.436 | 72.807 | | | | | | |
| 14 | .764 | 2.248 | 75.055 | | | | | | |
| 15 | .712 | 2.095 | 77.150 | | | | | | |
| 16 | .698 | 2.052 | 79.201 | | | | | | |
| 17 | .666 | 1.960 | 81.161 | | | | | | |
| 18 | .627 | 1.843 | 83.004 | | | | | | |
| 19 | .535 | 1.573 | 84.577 | | | | | | |
| 20 | .509 | 1.496 | 86.073 | | | | | | |
| 21 | .487 | 1.431 | 87.504 | | | | | | |
| 22 | .475 | 1.396 | 88.900 | | | | | | |
| 23 | .432 | 1.271 | 90.171 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 24 | .422 | 1.243 | 91.414 | | | | | | |
| 25 | .392 | 1.154 | 92.568 | | | | | | |
| 26 | .382 | 1.123 | 93.690 | | | | | | |
| 27 | .366 | 1.078 | 94.768 | | | | | | |
| 28 | .324 | .952 | 95.720 | | | | | | |
| 29 | .312 | .916 | 96.637 | | | | | | |
| 30 | .277 | .814 | 97.451 | | | | | | |
| 31 | .255 | .749 | 98.201 | | | | | | |
| 32 | .227 | .668 | 98.869 | | | | | | |
| 33 | .203 | .598 | 99.466 | | | | | | |
| 34 | .181 | .534 | 100.000 | | | | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix**[a]

| | Component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | | | .746 | | | | | | |
| 2 | | | | | | | .782 | | |
| 3 | | | | | | | .832 | | |
| 4 | | | | | | .659 | .278 | | |
| 5 | .483 | | | | | | | .288 | |
| 6 | | | | | | .672 | | | |
| 7 | | | | | | | | | .712 |
| 8 | | | .317 | | | .528 | .465 | | |
| 9 | | | .338 | .287 | | .451 | | | |
| 10 | | | | | | | | | .775 |
| 11 | | | .764 | | | | | | |
| 12 | .783 | | | | | | | | |
| 13 | .580 | | .328 | .344 | | | | | |
| 14 | .575 | | | .320 | | | | .363 | |
| 15 | .463 | .284 | | | .481 | | | | |
| 16 | .794 | | | | | | | | |
| 17 | .516 | .272 | | | .479 | | | | |
| 18 | .666 | | | | | | | .312 | |
| 19 | | | | .478 | .488 | | | | |
| 20 | | | | .696 | | .286 | | | |
| 21 | | | | | .749 | | | | |
| 22 | .330 | | | .495 | .301 | | | .265 | |
| 23 | | | | .291 | .353 | .372 | | | |
| 24 | | | .321 | .711 | | | | | |
| 25 | .418 | | | | | | .285 | .392 | |
| 26 | | | .305 | .289 | | | | .589 | |
| 27 | | | | | | | | .723 | |
| 28 | | | .635 | .317 | | | | | |
| 29 | | | .388 | | .568 | .340 | | | |
| 30 | | .542 | .278 | | | | | | |
| 31 | | .644 | | | | | | | .401 |
| 32 | | .738 | | | | | | | |
| 33 | | .675 | | | | | | .259 | |
| 34 | | .717 | | | | | | | |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 5\12\13\14\16\17\18\25 | 10.941 | 10.941 | 0.175621 |
| 2 | 30\31\32\33\34 | 7.984 | 18.925 | 0.128156 |
| 3 | 1\11\28 | 7.599 | 26.524 | 0.121976 |
| 4 | 20\22\24 | 7.257 | 33.78 | 0.116487 |

a. otation converged in 9

GR TEST

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 6.769 | 19.909 | 19.909 | 6.769 | 19.909 | 19.909 |
| 2 | 3.032 | 8.918 | 28.827 | 3.032 | 8.918 | 28.827 |
| 3 | 2.731 | 8.033 | 36.859 | 2.731 | 8.033 | 36.859 |
| 4 | 2.066 | 6.078 | 42.937 | 2.066 | 6.078 | 42.937 |
| 5 | 1.675 | 4.925 | 47.862 | 1.675 | 4.925 | 47.862 |
| 6 | 1.530 | 4.501 | 52.364 | 1.530 | 4.501 | 52.364 |
| 7 | 1.342 | 3.948 | 56.312 | 1.342 | 3.948 | 56.312 |
| 8 | 1.180 | 3.472 | 59.784 | 1.180 | 3.472 | 59.784 |
| 9 | 1.048 | 3.081 | 62.865 | 1.048 | 3.081 | 62.865 |
| 10 | 1.019 | 2.997 | 65.862 | 1.019 | 2.997 | 65.862 |
| 11 | .957 | 2.815 | 68.678 | | | |
| 12 | .942 | 2.769 | 71.447 | | | |
| 13 | .786 | 2.312 | 73.760 | | | |
| 14 | .744 | 2.188 | 75.947 | | | |
| 15 | .675 | 1.987 | 77.934 | | | |
| 16 | .657 | 1.933 | 79.866 | | | |
| 17 | .625 | 1.838 | 81.704 | | | |
| 18 | .586 | 1.724 | 83.428 | | | |
| 19 | .547 | 1.610 | 85.038 | | | |
| 20 | .530 | 1.560 | 86.597 | | | |
| 21 | .494 | 1.453 | 88.051 | | | |
| 22 | .483 | 1.421 | 89.471 | | | |
| 23 | .427 | 1.257 | 90.729 | | | |
| 24 | .406 | 1.193 | 91.921 | | | |
| 25 | .388 | 1.142 | 93.063 | | | |
| 26 | .364 | 1.072 | 94.135 | | | |
| 27 | .352 | 1.035 | 95.170 | | | |
| 28 | .322 | .948 | 96.118 | | | |
| 29 | .271 | .797 | 96.915 | | | |
| 30 | .263 | .774 | 97.689 | | | |
| 31 | .241 | .709 | 98.398 | | | |
| 32 | .215 | .631 | 99.029 | | | |
| 33 | .185 | .545 | 99.575 | | | |
| 34 | .145 | .425 | 100.000 | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | .368 | .365 | | | -.336 | | | .250 | | |
| 2 | .320 | .601 | | | | .289 | .316 | | | |
| 3 | .393 | .544 | | | | .319 | | -.350 | | |
| 4 | | .397 | | | | .404 | | -.388 | .349 | |
| 5 | .274 | .412 | | | | -.534 | | | .346 | |
| 6 | .346 | .329 | | | -.259 | -.362 | .264 | | | |
| 7 | .305 | .360 | -.294 | | | | -.394 | .338 | | |
| 8 | .352 | .454 | | | .313 | | | | -.336 | .323 |
| 9 | .355 | .483 | | | | | .317 | | | |
| 10 | .251 | .467 | | | .290 | | | | .286 | |
| 11 | .338 | | | .279 | | | -.454 | .335 | | -.258 |
| 12 | .498 | | -.490 | -.263 | .290 | | | | | |
| 13 | .556 | -.253 | -.294 | -.312 | | -.266 | | | | |
| 14 | .601 | -.339 | -.311 | | | | | | | |
| 15 | .520 | -.271 | | -.358 | | | | .285 | | |
| 16 | .571 | -.270 | -.345 | | .255 | | | | | |
| 17 | .557 | | | | | | | | | -.348 |
| 18 | .635 | -.251 | | -.288 | | | | | | |
| 19 | .458 | | | | -.302 | .494 | .250 | | | |
| 20 | .588 | | | | -.352 | | -.282 | | | .250 |
| 21 | .393 | | | | | | | | | .530 |
| 22 | .557 | -.304 | | .285 | | | | | | |
| 23 | .626 | | | .267 | | | | | | |
| 24 | .672 | | | | | | -.280 | | | |
| 25 | .549 | | | .371 | | | | | | |
| 26 | .468 | | | | | -.293 | | | .354 | |
| 27 | .360 | | .259 | .527 | | | | | | |
| 28 | .375 | | .254 | .496 | | | | | | |
| 29 | .284 | | | .383 | .571 | | | | | |
| 30 | .404 | .280 | | | | -.273 | -.299 | -.358 | | |
| 31 | .429 | | .602 | -.394 | | | | | | |
| 32 | .340 | | .580 | -.350 | | | | | | |
| 33 | .272 | | .586 | -.275 | .341 | | | .251 | | |
| 34 | .380 | | .616 | -.250 | | | | | | |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a.Rotation converged in 10 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 1\13\14\15\16\17\18\20\22\23\24\25\30 | 19.909 | 19.909 | 0.30228 |
| 2 | 2\3\8\9\10 | 8.918 | 28.827 | 0.13540 |
| 3 | 12\31\32\33\34 | 8.033 | 36.859 | 0.12197 |
| 4 | 27\28 | 6.078 | 42.937 | 0.09228 |
| 5 | 29 | 4.925 | 47.862 | 0.07478 |
| 6 | 5\6\19 | 4.501 | 52.364 | 0.06834 |
| 7 | 7\11 | 3.948 | 56.312 | 0.05994 |
| 8 | 4 | 3.472 | 59.784 | 0.05272 |
| 9 | 26 | 3.081 | 62.865 | 0.04678 |
| 10 | 21 | 2.997 | 65.862 | 0.04550 |

FR CONTROL

**Total Variance Explained**

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Square Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 7.017 | 20.638 | 20.638 | 7.017 | 20.638 | 20.638 | 5.782 | 17.005 | 17.005 |
| 2 | 5.769 | 16.968 | 37.605 | 5.769 | 16.968 | 37.605 | 3.758 | 11.052 | 28.057 |
| 3 | 3.467 | 10.196 | 47.802 | 3.467 | 10.196 | 47.802 | 3.686 | 10.840 | 38.897 |
| 4 | 2.415 | 7.104 | 54.905 | 2.415 | 7.104 | 54.905 | 3.548 | 10.435 | 49.332 |
| 5 | 2.207 | 6.490 | 61.395 | 2.207 | 6.490 | 61.395 | 2.786 | 8.195 | 57.527 |
| 6 | 1.877 | 5.520 | 66.916 | 1.877 | 5.520 | 66.916 | 2.236 | 6.578 | 64.105 |
| 7 | 1.709 | 5.026 | 71.941 | 1.709 | 5.026 | 71.941 | 1.943 | 5.715 | 69.820 |
| 8 | 1.416 | 4.165 | 76.107 | 1.416 | 4.165 | 76.107 | 1.666 | 4.901 | 74.721 |
| 9 | 1.056 | 3.107 | 79.213 | 1.056 | 3.107 | 79.213 | 1.528 | 4.493 | 79.213 |
| 10 | .992 | 2.916 | 82.130 | | | | | | |
| 11 | .901 | 2.651 | 84.781 | | | | | | |
| 12 | .832 | 2.447 | 87.228 | | | | | | |
| 13 | .748 | 2.199 | 89.427 | | | | | | |
| 14 | .624 | 1.834 | 91.261 | | | | | | |
| 15 | .460 | 1.352 | 92.613 | | | | | | |
| 16 | .414 | 1.218 | 93.831 | | | | | | |
| 17 | .374 | 1.101 | 94.932 | | | | | | |
| 18 | .341 | 1.004 | 95.935 | | | | | | |
| 19 | .252 | .743 | 96.678 | | | | | | |
| 20 | .251 | .737 | 97.415 | | | | | | |
| 21 | .194 | .570 | 97.985 | | | | | | |
| 22 | .147 | .433 | 98.418 | | | | | | |
| 23 | .132 | .388 | 98.806 | | | | | | |
| 24 | .112 | .329 | 99.135 | | | | | | |
| 25 | .075 | .220 | 99.355 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 26 | .066 | .194 | 99.549 | | | | | | |
| 27 | .053 | .155 | 99.704 | | | | | | |
| 28 | .041 | .122 | 99.826 | | | | | | |
| 29 | .027 | .081 | 99.907 | | | | | | |
| 30 | .015 | .044 | 99.951 | | | | | | |
| 31 | .010 | .029 | 99.980 | | | | | | |
| 32 | .005 | .016 | 99.996 | | | | | | |
| 33 | .001 | .004 | 99.999 | | | | | | |
| 34 | .000 | .001 | 100.000 | | | | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | .427 | | | .369 | | | | | -.462 |
| 2 | .861 | | | | | | | -.328 | |
| 3 | .875 | | | | | | | -.322 | |
| 4 | .854 | | | | | | | -.331 | |
| 5 | .582 | | | | | | | .303 | |
| 6 | .898 | | | | | | | | |
| 7 | .911 | | | | | | | | |
| 8 | .907 | | | | | | | | |
| 9 | .325 | | | | | -.735 | | | |
| 10 | | | | | -.305 | | .710 | | |
| 11 | | | | .691 | | | | | |
| 12 | | .824 | | | | | .303 | | |
| 13 | | .900 | | | | | | | |
| 14 | | | | .801 | | | | | |
| 15 | | | .849 | | | | | | |
| 16 | | .821 | | .362 | | | | | |
| 17 | | | .812 | | | | | | |
| 18 | | .550 | | .466 | | | | -.488 | |
| 19 | | | .729 | | | | | | |
| 20 | | | | .543 | | | .339 | .330 | |
| 21 | | | | .882 | | | | | |
| 22 | | | | | | | .768 | | |
| 23 | -.304 | | .329 | | | | | .505 | |
| 24 | | | | | | | | | .855 |
| 25 | | | | .432 | .496 | | | .549 | |
| 26 | | | .463 | | .592 | | | | |
| 27 | | | | | .713 | -.375 | | | |
| 28 | | | | | .785 | | | | |
| 29 | | | .337 | -.372 | .570 | | | | |
| 30 | | .533 | | .358 | .493 | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31 | | .502 | | | | .599 | .312 | | |
| 32 | | | .730 | | | | | | |
| 33 | | .395 | .462 | | | .503 | | | |
| 34 | .301 | .328 | | | | .663 | | | |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a. Rotation converged in 11 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 2\3\4\5\6\7\8 | 17.005 | 17.005 | 0.214674 |
| 2 | 12\13\16\18\30\31 | 11.052 | 28.057 | 0.139523 |
| 3 | 15\17\19\32 | 10.84 | 38.897 | 0.136846 |
| 4 | 11\14\20\21 | 10.435 | 49.332 | 0.131733 |
| 5 | 26\27\28\29 | 8.195 | 57.527 | 0.103455 |
| 6 | 9\31\33\34 | 6.578 | 64.105 | 0.083042 |
| 7 | 10\22 | 5.715 | 69.82 | 0.072147 |
| 8 | 23\25 | 4.901 | 74.721 | 0.061871 |
| 9 | 1\24 | 4.493 | 79.213 | 0.05672 |

FR TEST

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 10.447 | 30.726 | 30.726 | 10.447 | 30.726 | 30.726 | 7.012 | 20.624 | 20.624 |
| 2 | 4.325 | 12.722 | 43.448 | 4.325 | 12.722 | 43.448 | 4.818 | 14.171 | 34.796 |
| 3 | 2.811 | 8.267 | 51.715 | 2.811 | 8.267 | 51.715 | 3.646 | 10.723 | 45.519 |
| 4 | 2.037 | 5.991 | 57.706 | 2.037 | 5.991 | 57.706 | 2.869 | 8.439 | 53.958 |
| 5 | 1.978 | 5.817 | 63.523 | 1.978 | 5.817 | 63.523 | 2.713 | 7.979 | 61.937 |
| 6 | 1.513 | 4.451 | 67.975 | 1.513 | 4.451 | 67.975 | 1.820 | 5.353 | 67.290 |
| 7 | 1.285 | 3.780 | 71.755 | 1.285 | 3.780 | 71.755 | 1.432 | 4.212 | 71.502 |
| 8 | 1.182 | 3.476 | 75.230 | 1.182 | 3.476 | 75.230 | 1.268 | 3.729 | 75.230 |
| 9 | .959 | 2.821 | 78.052 | | | | | | |
| 10 | .898 | 2.642 | 80.693 | | | | | | |
| 11 | .784 | 2.306 | 82.999 | | | | | | |
| 12 | .736 | 2.164 | 85.163 | | | | | | |
| 13 | .657 | 1.931 | 87.095 | | | | | | |
| 14 | .563 | 1.655 | 88.750 | | | | | | |
| 15 | .469 | 1.380 | 90.130 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 16 | .432 | 1.270 | 91.400 | | | | | | |
| 17 | .381 | 1.120 | 92.519 | | | | | | |
| 18 | .352 | 1.036 | 93.555 | | | | | | |
| 19 | .299 | .879 | 94.434 | | | | | | |
| 20 | .290 | .853 | 95.287 | | | | | | |
| 21 | .270 | .795 | 96.082 | | | | | | |
| 22 | .219 | .644 | 96.726 | | | | | | |
| 23 | .194 | .570 | 97.296 | | | | | | |
| 24 | .179 | .527 | 97.823 | | | | | | |
| 25 | .147 | .433 | 98.256 | | | | | | |
| 26 | .132 | .388 | 98.644 | | | | | | |
| 27 | .113 | .331 | 98.975 | | | | | | |
| 28 | .083 | .244 | 99.219 | | | | | | |
| 29 | .075 | .222 | 99.441 | | | | | | |
| 30 | .065 | .192 | 99.633 | | | | | | |
| 31 | .046 | .137 | 99.769 | | | | | | |
| 32 | .034 | .099 | 99.868 | | | | | | |
| 33 | .025 | .073 | 99.941 | | | | | | |
| 34 | .020 | .059 | 100.000 | | | | | | |

Extraction Method: Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | | .502 | | .498 | | .372 | | -.304 |
| 2 | | .781 | | | | | | |
| 3 | | .761 | | | | | | |
| 4 | | -.643 | | | | | .342 | |
| 5 | | .755 | | | | | | |
| 6 | | .680 | | | | .400 | | |
| 7 | | .878 | | | | | | |
| 8 | | .824 | | | | | | |
| 9 | | | | | | | .897 | |
| 10 | | | | | | | | .863 |
| 11 | | | | .492 | | .480 | | |
| 12 | .917 | | | | | | | |
| 13 | .890 | | | | | | | |
| 14 | .847 | | | | | | | |
| 15 | .900 | | | | | | | |
| 16 | .683 | | .344 | .301 | | | | |
| 17 | .880 | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18 | .746 | | | | | | | |
| 19 | .676 | | | .359 | | | | |
| 20 | .844 | | | | | | | |
| 21 | | | | .641 | | | | |
| 22 | | | | .802 | | | | |
| 23 | .362 | | | | .656 | | | |
| 24 | | | | | .506 | | | -.512 |
| 25 | | | | .520 | .661 | | | |
| 26 | | | | .432 | .653 | | | |
| 27 | | | | | .726 | | | |
| 28 | | | | | .488 | .654 | | |
| 29 | .413 | .373 | .594 | | | | | |
| 30 | | | .807 | .309 | | | | |
| 31 | | | .792 | | | | | |
| 32 | | | .777 | | | | | |
| 33 | | | .855 | | | | | |
| 34 | | | | | | .722 | | |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a.Rotation converged in 10 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 12\13\14\15\25\16\17\18\19 | 20.624 | 20.624 | 0.274146 |
| 2 | 1\2\3\4\5\6\7\8 | 14.171 | 34.796 | 0.188369 |
| 3 | 29\30\31\32\33 | 10.723 | 45.519 | 0.142536 |
| 4 | 11\21\22 | 8.439 | 53.958 | 0.112176 |
| 5 | 23\24\25\26\27 | 7.979 | 61.937 | 0.106061 |
| 6 | 28\34 | 5.353 | 67.29 | 0.071155 |
| 7 | 9 | 4.212 | 71.502 | 0.055988 |
| 8 | 10 | 3.729 | 75.23 | 0.049568 |

UK CONTROL

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Square Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 10.253 | 30.157 | 30.157 | 10.253 | 30.157 | 30.157 | 4.826 | 14.193 | 14.193 |
| 2 | 2.820 | 8.295 | 38.452 | 2.820 | 8.295 | 38.452 | 3.371 | 9.916 | 24.108 |
| 3 | 2.372 | 6.977 | 45.429 | 2.372 | 6.977 | 45.429 | 3.069 | 9.026 | 33.134 |
| 4 | 1.804 | 5.305 | 50.734 | 1.804 | 5.305 | 50.734 | 2.854 | 8.393 | 41.526 |
| 5 | 1.507 | 4.433 | 55.167 | 1.507 | 4.433 | 55.167 | 2.299 | 6.762 | 48.289 |
| 6 | 1.407 | 4.138 | 59.305 | 1.407 | 4.138 | 59.305 | 2.276 | 6.695 | 54.984 |
| 7 | 1.269 | 3.732 | 63.037 | 1.269 | 3.732 | 63.037 | 2.182 | 6.418 | 61.402 |
| 8 | 1.146 | 3.370 | 66.407 | 1.146 | 3.370 | 66.407 | 1.702 | 5.004 | 66.407 |
| 9 | .988 | 2.907 | 69.313 | | | | | | |
| 10 | .909 | 2.674 | 71.987 | | | | | | |
| 11 | .805 | 2.368 | 74.356 | | | | | | |
| 12 | .784 | 2.305 | 76.660 | | | | | | |
| 13 | .693 | 2.039 | 78.699 | | | | | | |
| 14 | .609 | 1.790 | 80.489 | | | | | | |
| 15 | .588 | 1.730 | 82.219 | | | | | | |
| 16 | .563 | 1.656 | 83.874 | | | | | | |
| 17 | .523 | 1.537 | 85.411 | | | | | | |
| 18 | .485 | 1.427 | 86.838 | | | | | | |
| 19 | .442 | 1.300 | 88.138 | | | | | | |
| 20 | .424 | 1.248 | 89.386 | | | | | | |
| 21 | .396 | 1.166 | 90.552 | | | | | | |
| 22 | .381 | 1.122 | 91.674 | | | | | | |
| 23 | .348 | 1.024 | 92.697 | | | | | | |
| 24 | .336 | .989 | 93.687 | | | | | | |
| 25 | .296 | .871 | 94.558 | | | | | | |
| 26 | .281 | .825 | 95.383 | | | | | | |
| 27 | .267 | .784 | 96.167 | | | | | | |
| 28 | .266 | .783 | 96.950 | | | | | | |
| 29 | .232 | .682 | 97.632 | | | | | | |
| 30 | .203 | .597 | 98.229 | | | | | | |
| 31 | .182 | .535 | 98.764 | | | | | | |
| 32 | .159 | .467 | 99.231 | | | | | | |
| 33 | .147 | .433 | 99.665 | | | | | | |
| 34 | .114 | .335 | 100.000 | | | | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 16 | .808 | | | | | | | |
| 14 | .807 | | | | | | | |
| 12 | .807 | | | | | | | |
| 22 | .699 | | | .308 | | | | |
| 18 | .653 | | | | | .355 | | |
| 25 | .527 | | | | | | | |
| 17 | .492 | | .316 | .343 | | .488 | | |
| 6 | | .745 | | | | | | |
| 7 | | .706 | | | | | | |
| 5 | | .681 | | | | | | |
| 8 | | .670 | | | .356 | | | |
| 10 | | .582 | | | | | | |
| 4 | | .572 | | | .497 | | | |
| 34 | | | .858 | | | | | |
| 31 | | | .796 | | | | | |
| 32 | | | .710 | | | | | |
| 33 | | | .652 | | | | | |
| 24 | | | | .719 | | | | |
| 20 | .436 | | | .676 | | | | |
| 19 | | | | .668 | | | | |
| I7 | | | | .629 | | .405 | | |
| 23 | .355 | | | .403 | | .332 | | |
| 2 | | | | | .823 | | | |
| 3 | | | | | .805 | | | |
| 29 | .322 | | | | | .655 | | |
| 28 | | | | | | .537 | .521 | |
| 15 | .391 | | .423 | | | .502 | | |
| 1 | | | | | .302 | | .663 | |
| 27 | .303 | | | | | | .661 | |
| 26 | | | | .375 | | | .581 | |
| 11 | .360 | | | | .377 | | .572 | |
| 30 | | | | | | | | .754 |
| 9 | | .481 | | | | | | .593 |
| 13 | .435 | | | .330 | | .357 | | .466 |

Extraction Method：Principle component analysis

Rotation Method：Vairmax with Kaiser Normalisation

a.Rotation converged in 8 iterations

| Component | Question No. | Variance contribution rate | Cumulative variance contribution rate | Weight |
|---|---|---|---|---|
| 1 | 12/14/16/17/18/22/25 | 30.157 | 30.157 | 0.454124 |
| 2 | 4/5/6/7/8/10 | 8.295 | 38.452 | 0.124912 |
| 3 | 31/32/33/34 | 6.977 | 45.429 | 0.105064 |
| 4 | 19/20/23/24/21 | 5.305 | 50.734 | 0.079886 |
| 5 | 2/3 | 4.433 | 55.167 | 0.066755 |
| 6 | 15/28/29 | 4.138 | 59.305 | 0.062313 |
| 7 | 1/11/26/27 | 3.732 | 63.037 | 0.056199 |
| 8 | 9/13/30 | 3.37 | 66.407 | 0.050748 |

UK TEST

Total Variance Explained

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Square Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 8.436 | 24.812 | 24.812 | 8.436 | 24.812 | 24.812 | 5.149 | 15.144 | 15.144 |
| 2 | 3.378 | 9.936 | 34.748 | 3.378 | 9.936 | 34.748 | 3.995 | 11.750 | 26.894 |
| 3 | 2.632 | 7.742 | 42.490 | 2.632 | 7.742 | 42.490 | 3.333 | 9.802 | 36.695 |
| 4 | 1.890 | 5.558 | 48.048 | 1.890 | 5.558 | 48.048 | 2.463 | 7.245 | 43.940 |
| 5 | 1.538 | 4.524 | 52.572 | 1.538 | 4.524 | 52.572 | 2.058 | 6.053 | 49.993 |
| 6 | 1.424 | 4.189 | 56.760 | 1.424 | 4.189 | 56.760 | 1.613 | 4.744 | 54.737 |
| 7 | 1.121 | 3.297 | 60.057 | 1.121 | 3.297 | 60.057 | 1.536 | 4.519 | 59.256 |
| 8 | 1.090 | 3.205 | 63.262 | 1.090 | 3.205 | 63.262 | 1.277 | 3.756 | 63.012 |
| 9 | 1.050 | 3.089 | 66.351 | 1.050 | 3.089 | 66.351 | 1.135 | 3.339 | 66.351 |
| 10 | .996 | 2.929 | 69.280 | | | | | | |
| 11 | .827 | 2.432 | 71.712 | | | | | | |
| 12 | .819 | 2.409 | 74.121 | | | | | | |
| 13 | .784 | 2.307 | 76.428 | | | | | | |
| 14 | .761 | 2.239 | 78.667 | | | | | | |
| 15 | .689 | 2.027 | 80.693 | | | | | | |
| 16 | .659 | 1.937 | 82.630 | | | | | | |
| 17 | .573 | 1.685 | 84.315 | | | | | | |
| 18 | .528 | 1.554 | 85.870 | | | | | | |
| 19 | .504 | 1.483 | 87.352 | | | | | | |
| 20 | .467 | 1.374 | 88.726 | | | | | | |
| 21 | .441 | 1.298 | 90.024 | | | | | | |
| 22 | .421 | 1.239 | 91.264 | | | | | | |
| 23 | .402 | 1.181 | 92.445 | | | | | | |
| 24 | .388 | 1.141 | 93.586 | | | | | | |
| 25 | .337 | .992 | 94.578 | | | | | | |
| 26 | .311 | .914 | 95.492 | | | | | | |
| 27 | .254 | .747 | 96.238 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 28 | .243 | .716 | 96.954 | | | | | | |
| 29 | .219 | .645 | 97.599 | | | | | | |
| 30 | .212 | .623 | 98.222 | | | | | | |
| 31 | .186 | .546 | 98.768 | | | | | | |
| 32 | .163 | .480 | 99.249 | | | | | | |
| 33 | .135 | .398 | 99.647 | | | | | | |
| 34 | .120 | .353 | 100.000 | | | | | | |

Extraction Method：Principle component analysis

**Rotation Component Matrix** [a]

| | Component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 14 | .818 | | | | | | | | |
| 16 | .803 | | | | | | | | |
| 22 | .766 | | | | | | | | |
| 12 | .739 | | | | | .308 | | | |
| 17 | .728 | | | | | | | .363 | |
| 18 | .717 | .313 | | | | | | | |
| 15 | .643 | | | | .418 | | | .331 | |
| 20 | .574 | .543 | | | | | | | |
| 24 | | .718 | | | | | | | |
| 29 | | .691 | | | | | | | |
| 26 | | .689 | | | | | | | |
| 28 | | .632 | | | .341 | .341 | | | |
| 21 | | .599 | | | | | | | |
| 23 | | .567 | | | | | | | |
| 25 | .304 | .502 | | | .309 | | | -.376 | |
| 27 | | .496 | | | | | | | |
| 2 | | | .875 | | | | | | |
| 3 | | | .871 | | | | | | |
| 7 | | | .774 | | | | | | |
| 8 | | | .640 | | | | | | -.351 |
| 6 | | | .473 | | | .426 | | | |
| 34 | | | | .807 | | | | | |
| 33 | .308 | | | .780 | | | | | |
| 32 | | | | .777 | | | | | |
| 30 | | | | | .735 | | | | |
| 13 | .411 | | | | .684 | | | | |
| 1 | | | .311 | | .492 | | | | |
| 11 | | | | | | .703 | | | |
| 5 | | | .405 | | | .559 | .306 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | .741 | | |
| 4 | | | -.399 | | | | .557 | | |
| 9 | | | | -.382 | | | .498 | | |
| 19 | | .402 | | | | | | .621 | |
| 31 | | | | | | | | | .870 |

Extraction Method：Principle component analysis

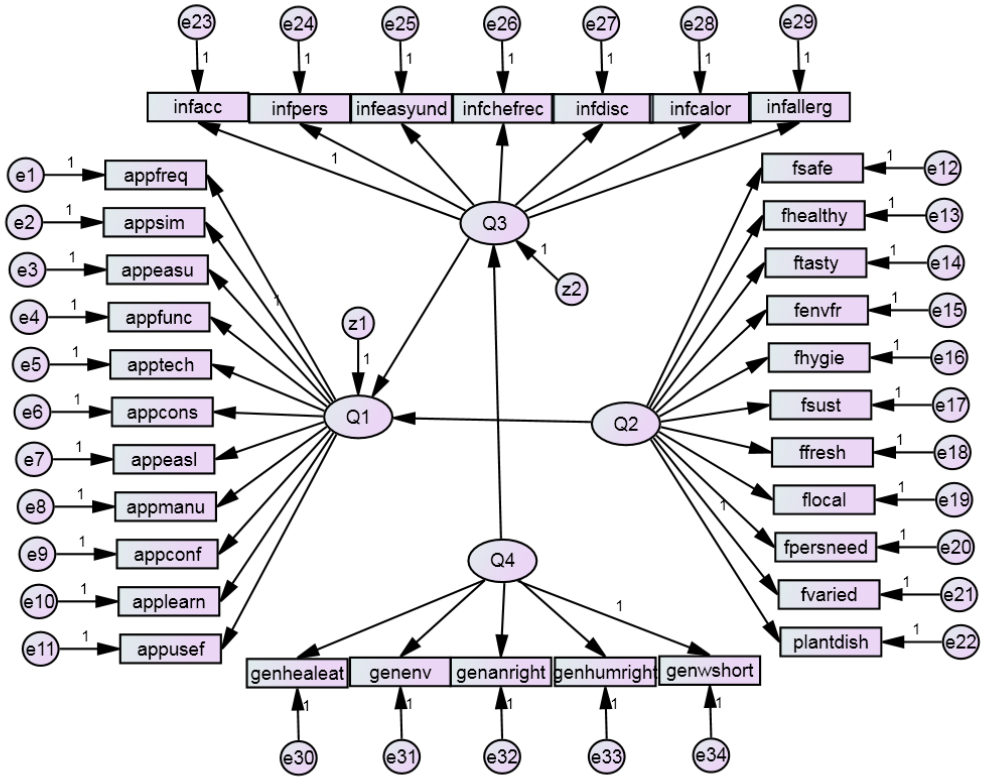
Rotation Method：Vairmax with Kaiser Normalisation

a.Rotation converged in 8 iterations

# Appendix 4

Control Group Model

Initial Model




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Initial Model | 6.472 | 0.108 | 0.730 | 0.567 | 0.608 | 0.606 | 0.098 | 3533.575 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

When the initial model is obtained, the validity of the model can be judged by the goodness of the fitted indicator, and the standard can be appropriately relaxed according to the actual situation.

However, the evaluation of this indicator is not the only evaluation of the model, and it is necessary to pay attention to the rational interpretation of the indicator.

The chi-squared value divided by the degree of freedom (CMIN/DF) cannot reach the range, and both the absolute fitting index and the information fitting index meet the requirements, and the model needs to be revised.

The commonly used evaluation index is as follows:

| Name of the Index | |
|---|---|
| Absolute fit index | $\chi^2$ (chi-square) |
| | GFI |
| | RMSEA |
| Comparative fit index | NFI |
| | CFI |
| | IFI |
| Information index | AIC |

The coefficients of the initial model were all significantly passed, indicating that the relationship between exogenous latent variables and endogenous latent variables is reasonable. At the same time, the measurement of latent variables for each two tables is also significantly passed. There is no need for changes in the paths.

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| Q3 | <--- | Q4 | .311 | .041 | 7.553 | *** | par_26 |
| Q1 | <--- | Q3 | .164 | .050 | 3.311 | *** | par_27 |
| Q1 | <--- | Q2 | .266 | .045 | 5.962 | *** | par_28 |
| appsim | <--- | Q1 | 1.000 | | | | |
| appfreq | <--- | Q1 | .652 | .108 | 6.016 | *** | par_1 |
| appeasu | <--- | Q1 | 1.000 | .083 | 12.066 | *** | par_2 |
| appfunc | <--- | Q1 | 1.063 | .083 | 12.801 | *** | par_3 |
| apptech | <--- | Q1 | .992 | .104 | 9.523 | *** | par_4 |

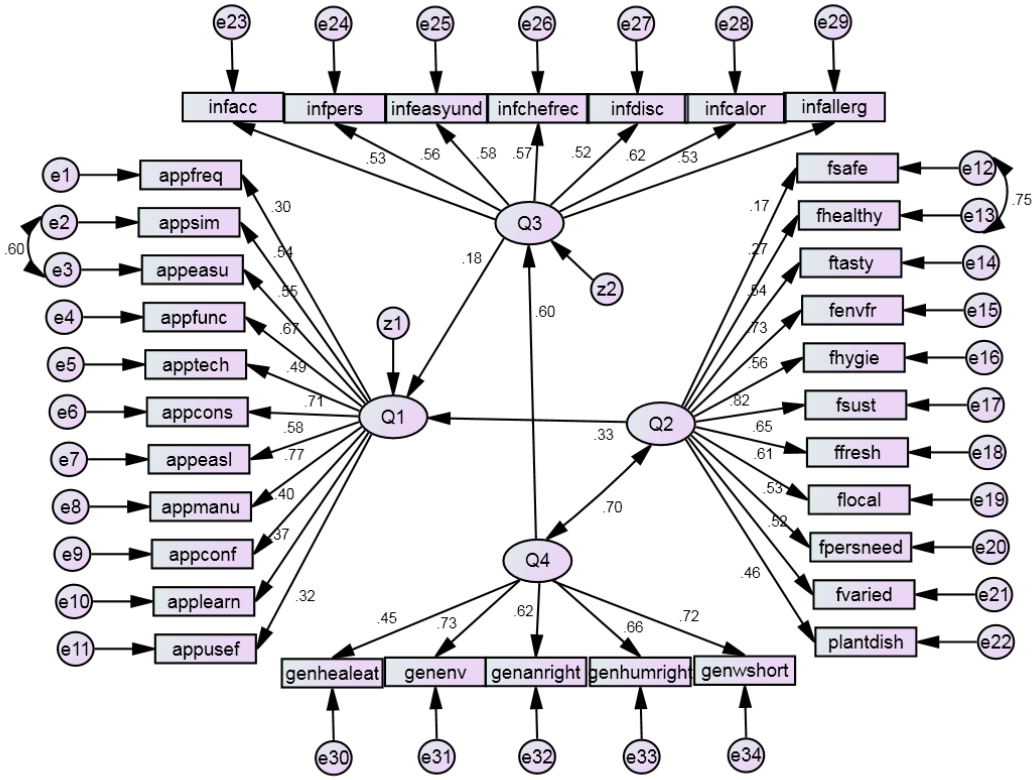
| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| appcons | <--- | Q1 | 1.185 | .094 | 12.606 | *** | par_5 |
| appeasl | <--- | Q1 | 1.051 | .097 | 10.884 | *** | par_6 |
| appmanu | <--- | Q1 | 1.190 | .087 | 13.700 | *** | par_7 |
| appconf | <--- | Q1 | .935 | .118 | 7.943 | *** | par_8 |
| applearn | <--- | Q1 | .989 | .132 | 7.489 | *** | par_9 |
| appusef | <--- | Q1 | .605 | .092 | 6.573 | *** | par_10 |
| fvaried | <--- | Q2 | 1.000 | | | | |
| fpersneed | <--- | Q2 | .965 | .103 | 9.403 | *** | par_11 |
| flocal | <--- | Q2 | 1.091 | .111 | 9.790 | *** | par_12 |
| ffresh | <--- | Q2 | .907 | .084 | 10.772 | *** | par_13 |
| fsust | <--- | Q2 | 1.288 | .112 | 11.555 | *** | par_14 |
| fhygie | <--- | Q2 | .677 | .067 | 10.053 | *** | par_15 |
| fenvfr | <--- | Q2 | 1.191 | .110 | 10.801 | *** | par_16 |
| ftasty | <--- | Q2 | .756 | .076 | 9.905 | *** | par_17 |
| fhealthy | <--- | Q2 | .712 | .110 | 6.483 | *** | par_18 |
| fsafe | <--- | Q2 | .510 | .099 | 5.132 | *** | par_19 |
| infacc | <--- | Q3 | 1.000 | | | | |
| infdisc | <--- | Q3 | 1.052 | .117 | 8.966 | *** | par_20 |
| infallerg | <--- | Q3 | 1.102 | .123 | 8.992 | *** | par_21 |
| genhealeat | <--- | Q4 | .528 | .059 | 8.888 | *** | par_22 |
| genenv | <--- | Q4 | 1.019 | .065 | 15.649 | *** | par_23 |
| genanright | <--- | Q4 | .921 | .069 | 13.393 | *** | par_24 |
| genhumright | <--- | Q4 | .820 | .058 | 14.261 | *** | par_25 |
| genwshort | <--- | Q4 | 1.000 | | | | |
| infeasyund | <--- | Q3 | .923 | .099 | 9.348 | *** | par_29 |

| | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|
| infpers | <--- Q3 | 1.170 | .128 | 9.162 | *** | par_30 |
| infcalor | <--- Q3 | 1.516 | .153 | 9.901 | *** | par_31 |
| plantdish | <--- Q2 | .788 | .090 | 8.752 | *** | par_32 |
| infchefrec | <--- Q3 | 1.245 | .132 | 9.447 | *** | par_33 |

When using the correction index to correct the model, it is generally estimated from the maximum value, which can effectively reduce the chi-square value of the model. At the same time, we must consider the actual situation and theoretical basis to analyze the considerations

There might be correlations between Q2, Q4 (i.e. personal importance given to specific features of the food provided by the canteen and overall concerns on food issues). Similarly, there are correlations between e12 and e13 and between e2 and e3. Considering this issue, 3 double arrows below are added to the model.

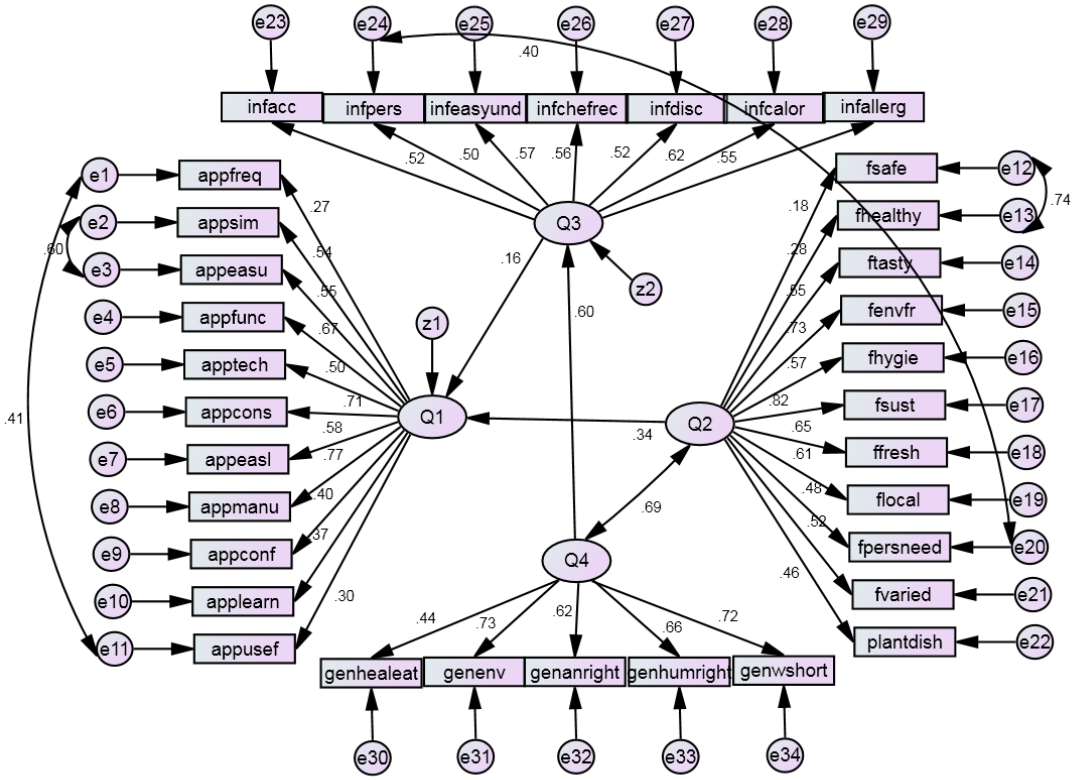
| | M.I. | Par Change |
|---|---|---|
| Q2 <--> Q4 | 163.472 | .200 |
| e13 <--> e12 | 313.036 | .780 |
| e2 <--> e3 | 189.524 | .154 |




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 2 | 4.314 | 0.067 | 0.780 | 0.690 | 0.726 | 0.737 | 0.082 | 2656.057 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Compared with the initial model, each indicator has improved. 2 double arrows were added due to correlations between e20 and e24 and between e1 and e11. Adjustment continues.

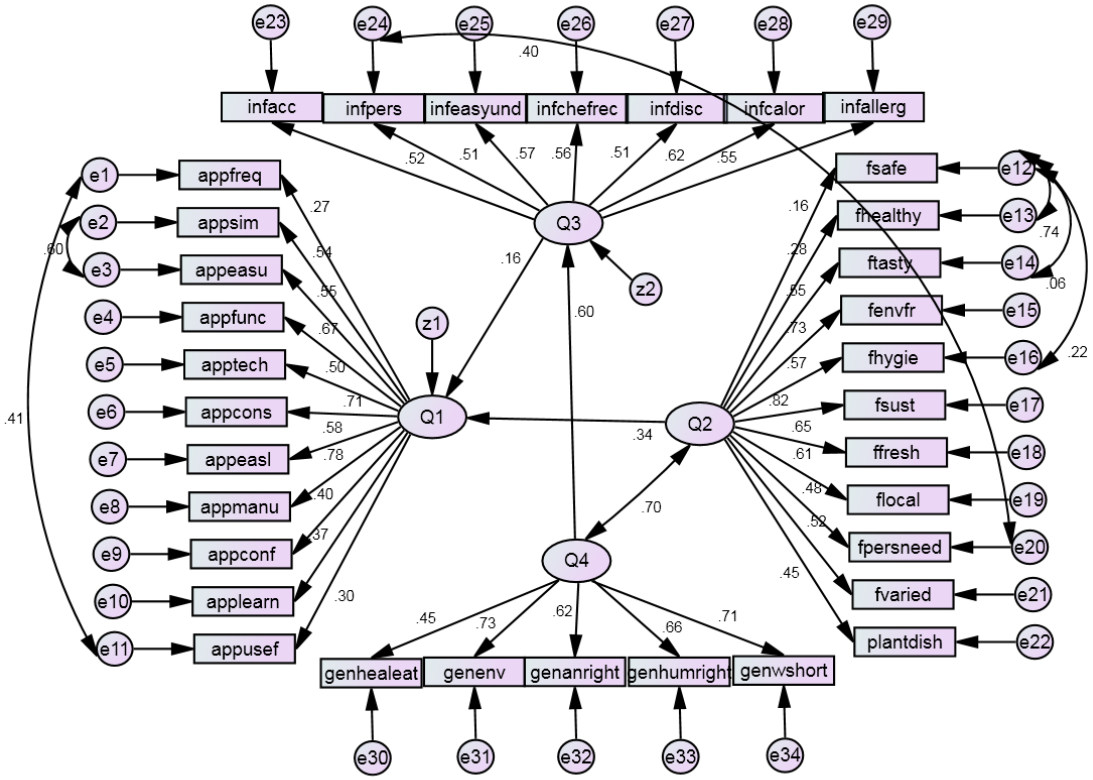
| | M.I. | Par Change |
|---|---|---|
| e20 <--> e24 | 72.628 | .211 |
| e1 <--> e11 | 91.418 | .255 |




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 3 | 3.483 | 0.067 | 0.801 | 0.723 | 0.751 | 0.771 | 0.078 | 2478.904 |
| Theoretical model | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable model | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Paths added due to correlations.

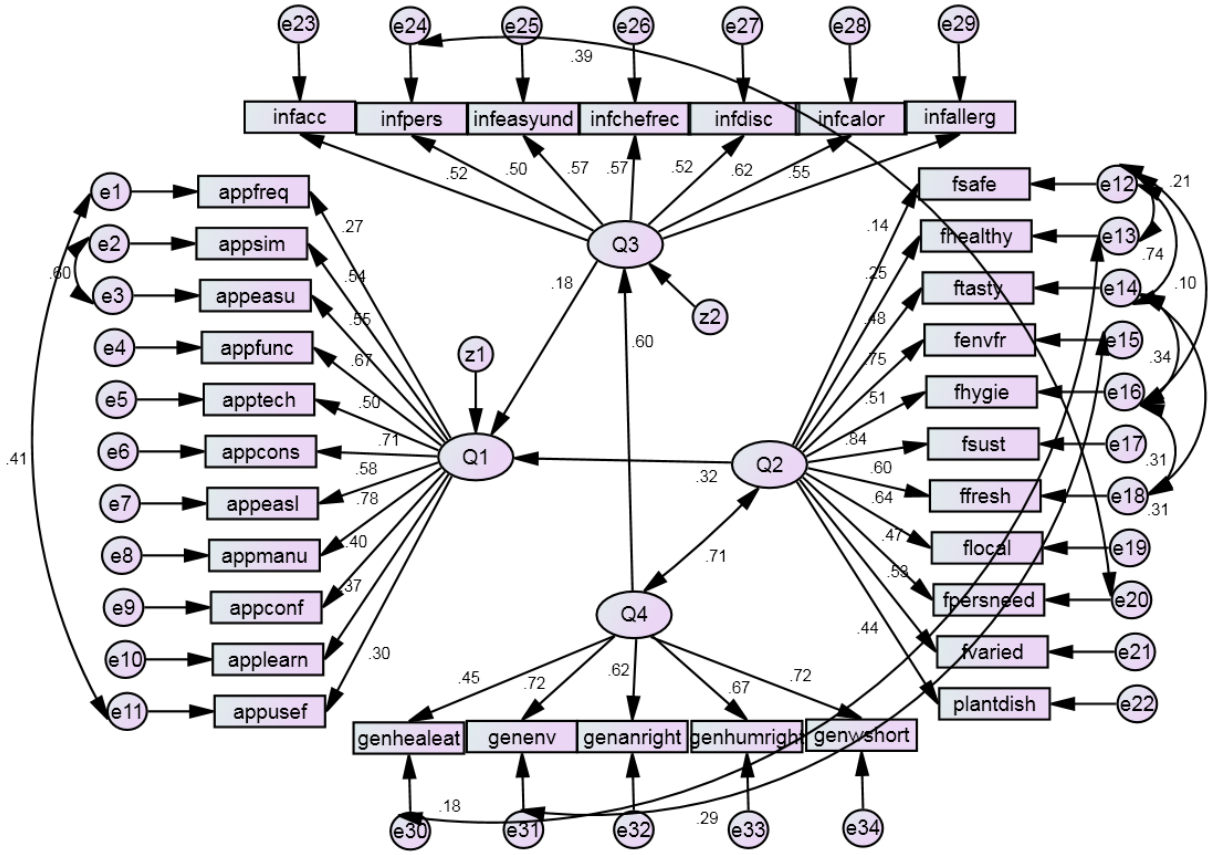
| | M.I. | Par Change |
|---|---|---|
| e16 <--> e12 | 61.402 | .106 |
| e16 <--> e14 | 54.229 | .081 |




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 4 | 3.365 | 0.067 | 0.801 | 0.732 | 0.782 | 0.781 | 0.077 | 2412.630 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Paths added due to correlations.

| | M.I. | Par Change |
|---|---|---|
| e13 <--> e30 | 43.910 | .143 |
| e15 <--> e31 | 42.049 | .113 |
| e16 <--> e14 | 48.478 | .072 |
| e18 <--> e14 | 43.153 | .079 |
| e18 <--> e16 | 43.819 | .065 |

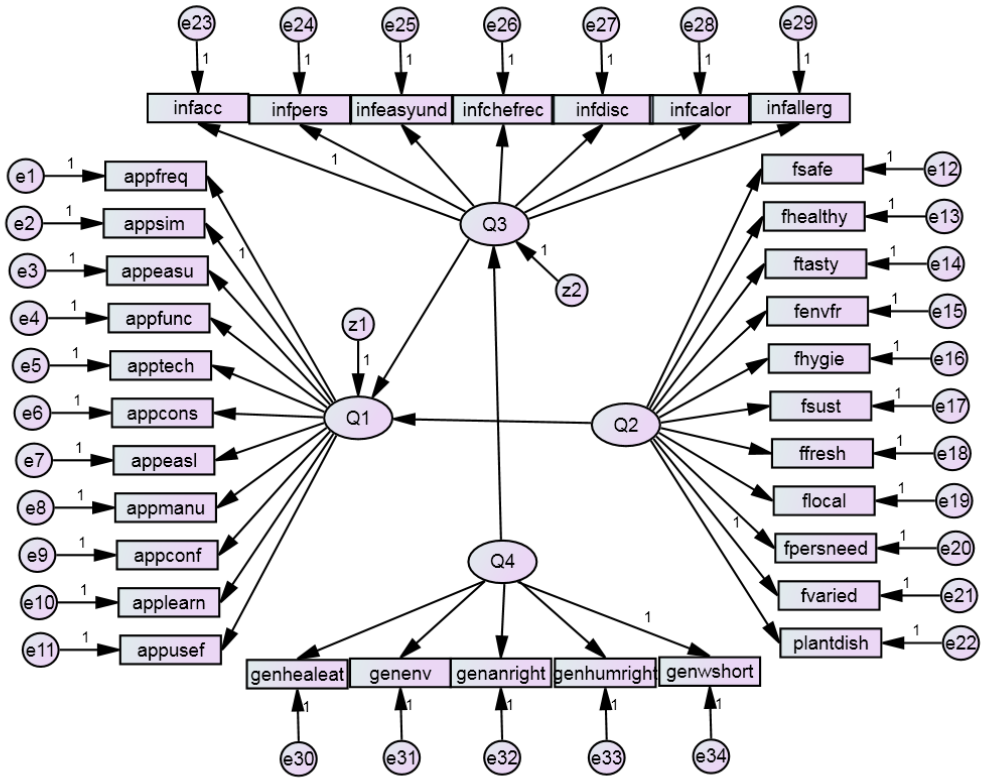



| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Final model | 2.689 | 0.066 | 0.847 | 0.761 | 0.801 | 0.821 | 0.072 | 2197.581 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

All the index fitted.

Test group model

Initial Model




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Initial model | 6.472 | 0.108 | 0.730 | 0.567 | 0.608 | 0.606 | 0.098 | 3533.575 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Considerate deleting the path from Q3 to Q1 due to high p value in t-test. (marked yellow)

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| Q3 | <--- | Q4 | .260 | .044 | 5.908 | *** | par_26 |
| Q1 | <--- | Q3 | .055 | .070 | .788 | .431 | par_27 |
| Q1 | <--- | Q2 | .264 | .065 | 4.082 | *** | par_28 |
| appsim | <--- | Q1 | 1.000 | | | | |
| appfreq | <--- | Q1 | .739 | .091 | 8.154 | *** | par_1 |
| appeasu | <--- | Q1 | .988 | .064 | 15.403 | *** | par_2 |

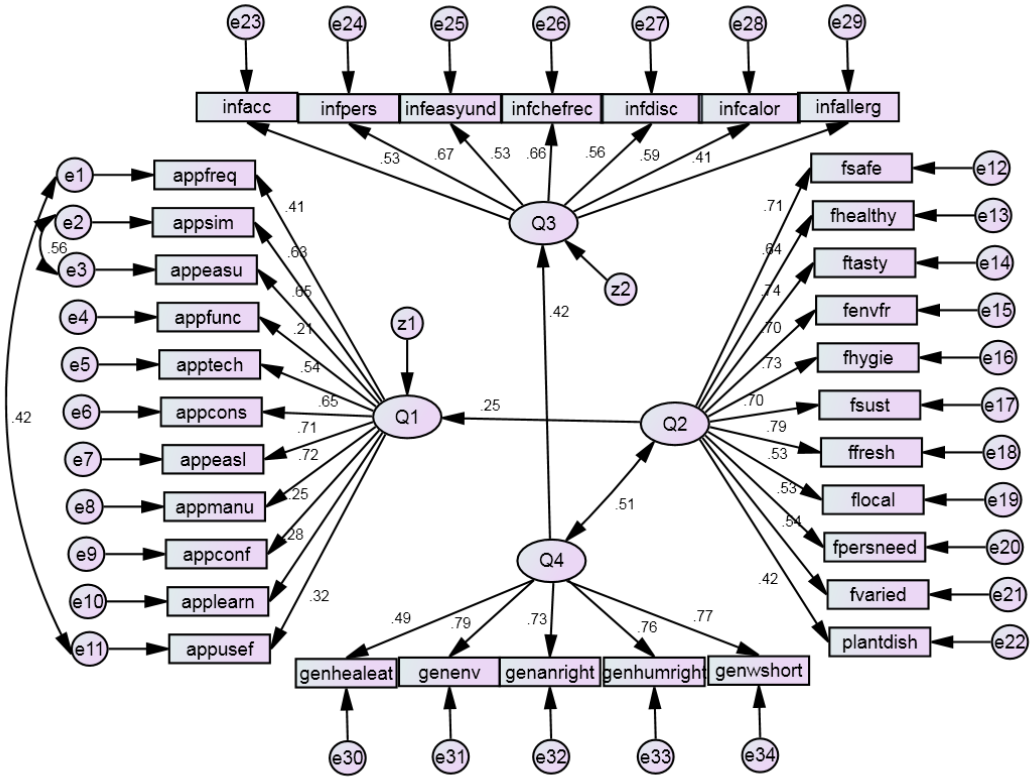
| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| appfunc | <--- | Q1 | .448 | .127 | 3.538 | *** | par_3 |
| apptech | <--- | Q1 | .748 | .074 | 10.089 | *** | par_4 |
| appcons | <--- | Q1 | .784 | .065 | 12.110 | *** | par_5 |
| appeasl | <--- | Q1 | .886 | .064 | 13.740 | *** | par_6 |
| appmanu | <--- | Q1 | .952 | .069 | 13.854 | *** | par_7 |
| appconf | <--- | Q1 | .418 | .097 | 4.331 | *** | par_8 |
| applearn | <--- | Q1 | .426 | .082 | 5.184 | *** | par_9 |
| appusef | <--- | Q1 | .475 | .076 | 6.228 | *** | par_10 |
| fvaried | <--- | Q2 | 1.000 | | | | |
| fpersneed | <--- | Q2 | .913 | .103 | 8.899 | *** | par_11 |
| flocal | <--- | Q2 | 1.032 | .118 | 8.766 | *** | par_12 |
| ffresh | <--- | Q2 | 1.173 | .103 | 11.412 | *** | par_13 |
| fsust | <--- | Q2 | 1.163 | .110 | 10.594 | *** | par_14 |
| fhygie | <--- | Q2 | 1.032 | .094 | 11.002 | *** | par_15 |
| fenvfr | <--- | Q2 | 1.212 | .116 | 10.487 | *** | par_16 |
| ftasty | <--- | Q2 | 1.166 | .105 | 11.123 | *** | par_17 |
| fhealthy | <--- | Q2 | 1.072 | .106 | 10.126 | *** | par_18 |
| fsafe | <--- | Q2 | 1.014 | .093 | 10.870 | *** | par_19 |
| infacc | <--- | Q3 | 1.000 | | | | |
| infdisc | <--- | Q3 | 1.118 | .132 | 8.462 | *** | par_20 |
| infallerg | <--- | Q3 | .834 | .122 | 6.833 | *** | par_21 |
| genhealeat | <--- | Q4 | .660 | .068 | 9.745 | *** | par_22 |
| genenv | <--- | Q4 | 1.088 | .065 | 16.611 | *** | par_23 |
| genanright | <--- | Q4 | 1.124 | .073 | 15.418 | *** | par_24 |
| genhumright | <--- | Q4 | .927 | .059 | 15.687 | *** | par_25 |

| | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|
| genwshort | <--- Q4 | 1.000 | | | | |
| infeasyund | <--- Q3 | .876 | .107 | 8.221 | *** | par_29 |
| infpers | <--- Q3 | 1.271 | .136 | 9.320 | *** | par_30 |
| infcalor | <--- Q3 | 1.392 | .160 | 8.694 | *** | par_31 |
| plantdish | <--- Q2 | .712 | .095 | 7.485 | *** | par_32 |
| infchefrec | <--- Q3 | 1.493 | .161 | 9.297 | *** | par_33 |

| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 2 | 4.013 | 0.096 | 0.768 | 0.676 | 0.735 | 0.733 | 0.081 | 2244.611 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Paths added due to correlations.

| | M.I. | Par Change |
|---|---|---|
| Q2 <--> Q4 | 87.522 | .148 |
| e1 <--> e11 | 83.640 | .306 |
| e2 <--> e3 | 100.580 | .121 |




All the index fitted.

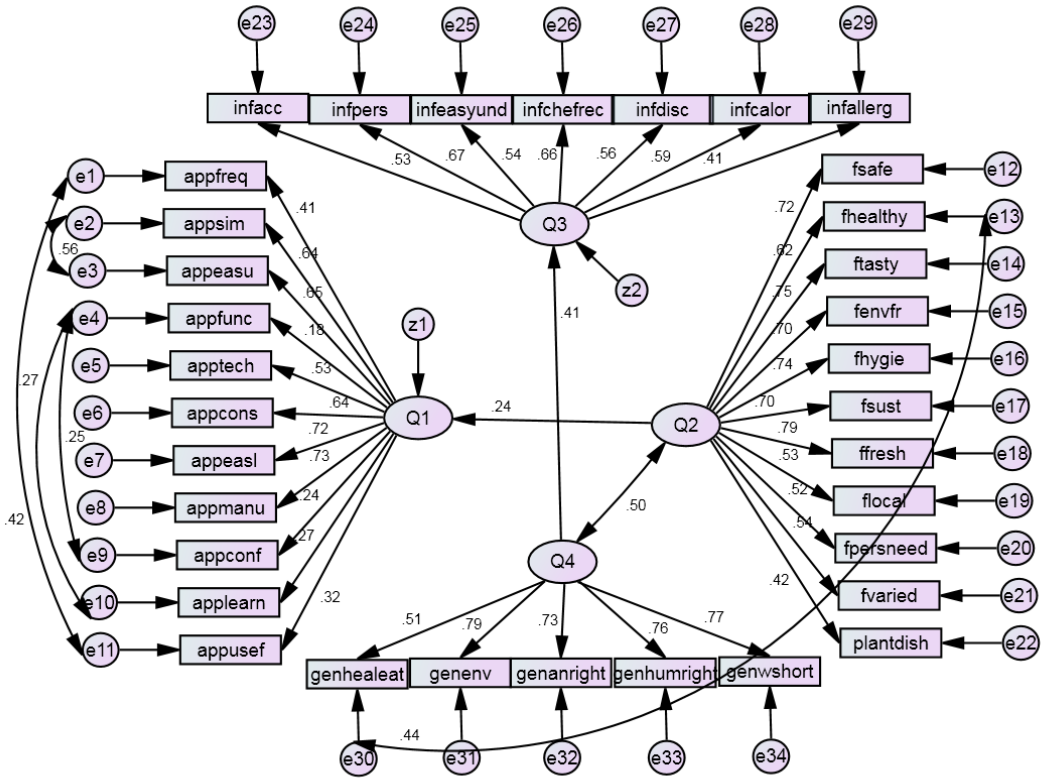
| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| Q3 | <--- | Q4 | .283 | .045 | 6.325 | *** | par_26 |
| Q1 | <--- | Q2 | .236 | .056 | 4.229 | *** | par_27 |
| appsim | <--- | Q1 | 1.000 | | | | |
| appfreq | <--- | Q1 | .885 | .117 | 7.551 | *** | par_1 |
| appeasu | <--- | Q1 | .992 | .059 | 16.927 | *** | par_2 |
| appfunc | <--- | Q1 | .624 | .156 | 4.001 | *** | par_3 |
| apptech | <--- | Q1 | .944 | .100 | 9.457 | *** | par_4 |
| appcons | <--- | Q1 | 1.000 | .091 | 10.953 | *** | par_5 |
| appeasl | <--- | Q1 | 1.100 | .094 | 11.717 | *** | par_6 |
| appmanu | <--- | Q1 | 1.192 | .101 | 11.836 | *** | par_7 |
| appconf | <--- | Q1 | .572 | .120 | 4.778 | *** | par_8 |

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| applearn | <--- | Q1 | .545 | .103 | 5.310 | *** | par_9 |
| appusef | <--- | Q1 | .583 | .096 | 6.047 | *** | par_10 |
| fvaried | <--- | Q2 | 1.000 | | | | |
| fpersneed | <--- | Q2 | .901 | .100 | 9.025 | *** | par_11 |
| flocal | <--- | Q2 | 1.046 | .115 | 9.064 | *** | par_12 |
| ffresh | <--- | Q2 | 1.146 | .099 | 11.593 | *** | par_13 |
| fsust | <--- | Q2 | 1.160 | .107 | 10.861 | *** | par_14 |
| fhygie | <--- | Q2 | 1.007 | .090 | 11.151 | *** | par_15 |
| fenvfr | <--- | Q2 | 1.222 | .113 | 10.817 | *** | par_16 |
| ftasty | <--- | Q2 | 1.129 | .100 | 11.234 | *** | par_17 |
| fhealthy | <--- | Q2 | 1.053 | .103 | 10.274 | *** | par_18 |
| fsafe | <--- | Q2 | .983 | .090 | 10.972 | *** | par_19 |
| infacc | <--- | Q3 | 1.000 | | | | |
| infdisc | <--- | Q3 | 1.112 | .132 | 8.445 | *** | par_20 |
| infallerg | <--- | Q3 | .834 | .122 | 6.840 | *** | par_21 |
| genhealeat | <--- | Q4 | .677 | .067 | 10.066 | *** | par_22 |
| genenv | <--- | Q4 | 1.077 | .065 | 16.636 | *** | par_23 |
| genanright | <--- | Q4 | 1.105 | .072 | 15.268 | *** | par_24 |
| genhumright | <--- | Q4 | .930 | .059 | 15.878 | *** | par_25 |
| genwshort | <--- | Q4 | 1.000 | | | | |
| infeasyund | <--- | Q3 | .872 | .106 | 8.210 | *** | par_28 |
| infpers | <--- | Q3 | 1.279 | .137 | 9.364 | *** | par_29 |
| infcalor | <--- | Q3 | 1.396 | .160 | 8.720 | *** | par_30 |
| plantdish | <--- | Q2 | .703 | .093 | 7.576 | *** | par_31 |
| infchefrec | <--- | Q3 | 1.489 | .160 | 9.302 | *** | par_32 |

| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 2 | 3.428 | 0.069 | 0.794 | 0.724 | 0.787 | 0.786 | 0.073 | 1935.164 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Paths added due to correlations.

| | M.I. | Par Change |
|---|---|---|
| e13 <--> e30 | 78.240 | .201 |
| e4 <--> e10 | 45.545 | .361 |
| e4 <--> e9 | 41.932 | .409 |

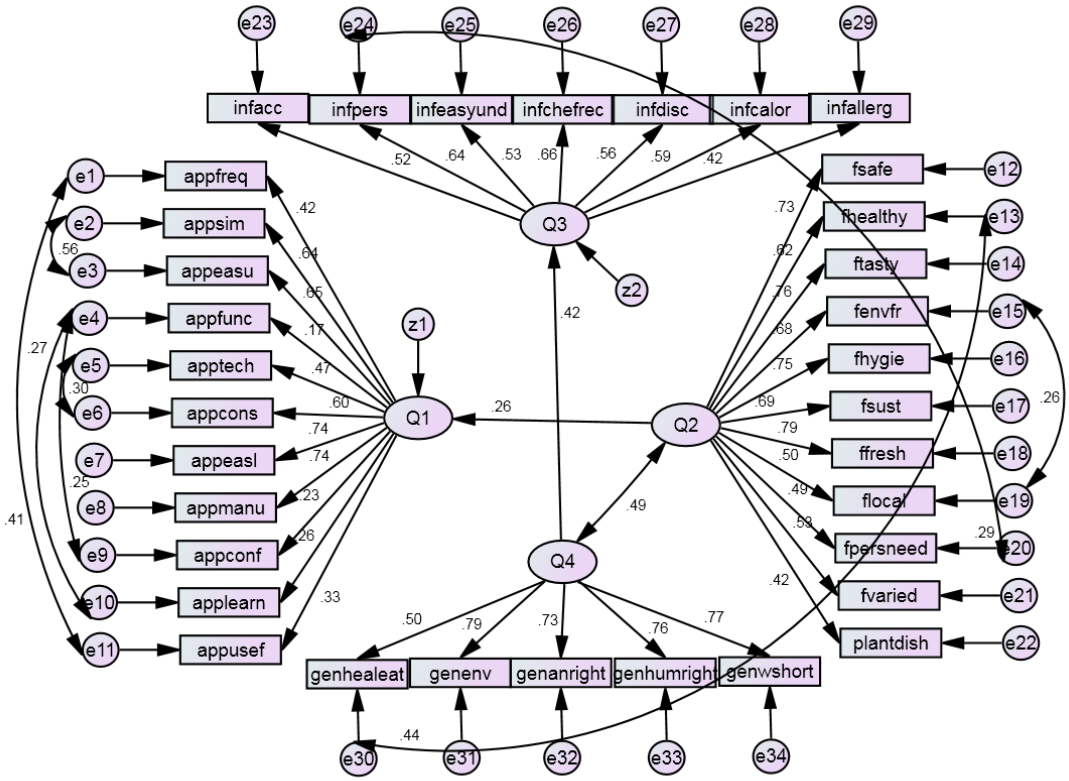



| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Model 3 | 3.131 | 0.066 | 0.811 | 0.749 | 0.815 | 0.813 | 0.068 | 1776.994 |
| Theoretical range | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable range | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |

Paths added due to correlations.

| | M.I. | Par Change |
|---|---|---|
| e19 <--> e15 | 24.257 | .119 |
| e20 <--> e24 | 25.912 | .113 |
| e5 <--> e6 | 31.270 | .107 |

After the correction, the model basically meets the requirements, and the added correlation path can also be well explained. The following final model is obtained.




| | CMIN/DE | RMR | GFI | NFI | IFI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|
| Final model | 2.775 | 0.066 | 0.843 | 0.783 | 0.849 | 0.848 | 0.066 | 1693.271 |
| Theoretical model | <2 | <0.05 | >0.9 | >0.9 | >0.9 | >0.9 | <0.05 | The smaller the better |
| Acceptable model | <3 | <0.08 | >0.8 | >0.8 | >0.8 | >0.8 | <0.08 | The smaller the better |