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PREFACE

The Food4Me project strives to determine the application of personalised nutrition, through the development of suitable business models, research on technological advances, and validation of delivery methods for personalised nutrition advice. Within the Food4Me project, WP 1 is responsible for developing concepts of business and value creation models for personalised nutrition services. In addition, WP1 explores the feasibility of business and value creation models in view of the present and future economic and societal environment. Business models are defined in the broadest socio-economic sense, thus including any possible form of organised value creation from commercial approaches by companies to systems put in place by government or other societal interest groups. By developing concepts of business and value creation models, WP 1 explores opportunities to improve the public health situation, which may contribute to the creation of both economic and social wealth.

Prior WP1 studies established a global inventory of existing personalised nutrition services currently in the market place (Task 1.1.1) (Ronteltap et al. 2013) and recorded consumer perceptions of archetypical personalised nutrition services through focus group discussions (Task 1.1.2) (Berezowska et al. 2014). To get more insight into consumer acceptance of personalised nutrition services and with that increase their feasibility, the current report quantifies the previously established findings and records consumer perceptions of (novel) business model concepts (Task 1.3.2). The report provides necessary insights into the barriers and opportunities for the introduction of (novel) personalised nutrition business models.

INTRODUCTION

Using personalisation to accommodate the needs of individual consumers has become one of the leading concepts in service development (e.g. Kwon et al. 2010). For personalisation to take place, consumers need to disclose personal information to a service provider that generates the personalised service and subsequently provides it to the consumer (Sunikka and Bragge 2012). From a consumer perspective, disclosing personal information for the purpose of personalisation is a double-edged sword. That is, disclosing personal information results in services that are presumably most in line with consumers' specific needs (Hunt et al. 2013), but may at the same time involve (severe) negative consequences caused by privacy loss (Mothersbaugh et al. 2012). For instance, disclosing information regarding previous purchases to an online shop may result in highly personalised product recommendations, but may also lead to an individual's shopping profile being used for extensive advertisement and spam. Being able to enjoy the benefits of personalisation is practically impossible without becoming exposed to some degree of privacy risk (van Doorn and Hoekstra 2013). Consumers' willingness to disclose personal information in return for personalisation benefits, while putting their privacy at risk may be decisive for the adoption of personalised services.

Personal information that allows for personalisation varies in breadth and depth (Taddei and Contena 2013). Information breadth denotes the quantity of the required information, whereas information depth refers to the intimacy level of the information (Lee et al. 2013). Based on the extent to which the information approaches an individual's core identity, personal information can be classified into four categories that increase in intimacy level: 1) individual information (e.g. physical appearance and shopping habits), 2) private information (e.g. hobbies and musical taste), 3) sensitive information (e.g. current health status and financial information), and 4) unique information (e.g. DNA and medical history) (Marx 2005). Whether information quantity and intimacy will affect the adoption of personalised services depends on the extent to which consumers are concerned about disclosing particular amounts and types of personal information to a service provider. Adoption of personalised services may become especially jeopardised when consumers believe that the benefits resulting from information disclosure do not offset the risks associated with information disclosure.

Consumers assess the balance between co-occurring risks and benefits on the basis of a risk-benefit trade-off, often called the Privacy Calculus (Culnan and Armstrong 1999). Prior studies applied

the Privacy Calculus to personalisation where the intimacy level of the required personal information was limited to individual, private, and sensitive information (e.g. Awad and Krishnan 2006; Chellappa and Sin 2005; Keith et al. 2013; Xu et al. 2011; Xu et al. 2009). Although the Privacy Calculus has been suggested as being relevant for the disclosure of unique personal information (Anderson and Agarwal 2011; Berezowska et al. 2014), empirical support for this suggestion is lacking. Currently it is assumed that progressive levels of information intimacy lead to both higher privacy risk (Malhotra et al. 2004; Dinev et al. 2013) and higher personalisation benefit (Rimbach and Minihane 2009) perceptions. Despite being concerned about the risks that may result from disclosing individual, private, and sensitive information (Li et al. 2011; Sheehan and Hoy 2000), consumers have shown to be likely to disclose these types of personal information to service providers when provided with attractive benefits (Keith et al. 2013; Acquisti et al. 2013). Whether these findings can be extended to unique personal information is not clear. Therefore, the present study adds to the current Privacy Calculus literature by identifying how, based on privacy risk and personalisation benefit perceptions, the Privacy Calculus determines consumers' adoption intention of personalised services that require individual, private, sensitive, and unique personal information.

The health domain provides a suitable research context to investigate different intimacy levels of personal information, as health advice can be based on private (e.g. lifestyle), sensitive (e.g. blood results) and/or unique (e.g. DNA) personal information. When health advice is preventive rather than curative, a trade-off between risks and benefits may become particularly decisive in determining the choice to adopt or reject a health service. Personalised nutrition services are preventive health services that build on the premise: "tell us who you are, and we will tell you which foods are good/bad for you" (Ronteltap et al. 2013). Based on the current understanding of the relationship between nutrition and health, nutrition advice can be personalised on the basis of three types of personal information: 1) lifestyle (i.e. dietary intake and physical activity), 2) phenotype (i.e. current health status based on blood results), and 3) genetic make-up (i.e. DNA) (Rimbach and Minihane 2009; Gibney and Walsh 2013). Personalised nutrition being preventive and comprising private, sensitive, and unique personal information, makes it particularly suitable for our research aim.

Theoretical framework

Consumers' intention to adopt personalised services is determined by the shared impact of risk and benefit perceptions (Li 2012). The balance between desired benefits and undesired risks is assessed by combining risk and benefit perceptions into an overall information disclosure valuation, captured by the Privacy Calculus. The Privacy Calculus builds on the principles of behavioural decision making theories (e.g. Vroom 1964; Blau 1964; Kahneman and Tversky 1979) in assuming that consumers behave in ways that maximise positive outcomes (i.e. benefits) and minimise negative outcomes (i.e. risks) resulting from information disclosure (Keith et al. 2013). Hence, consumers will only be willing to adopt services that require information disclosure for the purpose of personalisation if the perceived benefits of information disclosure offset the perceived risks of information disclosure (Dinev and Hart 2006). When the outcome of the Privacy Calculus is positive (i.e. perceived benefits are greater than perceived risk), consumers are more inclined to disclose personal information for the purpose of personalisation. In contrast, a negative Privacy Calculus outcome (i.e. perceived benefits are lower than privacy risks) is likely to result in the rejection of personalised services (Xu et al. 2011). Therefore, we hypothesise that:

Hypothesis 1. *The more positive the outcome of the Privacy Calculus, the more likely consumers are to adopt personalised services.*

As risks and benefits of information disclosure for the purpose of personalisation generally revolve around privacy risks and personalisation benefits, we presume that the key drivers of the Privacy Calculus outcome will be consumer perceptions of personalisation benefit and privacy risk:

Hypothesis 2. *The Privacy Calculus outcome is determined by perceptions of both privacy risk and personalisation benefit.*

Personalisation benefits can be viewed in terms of the value that consumers receive in return for information disclosure (Chellappa and Sin 2005). The value of a service is, amongst others, embedded in the extent to which an individual expects that using a service will help him/her to attain a particular goal (Sweeney and Soutar 2001). Consumer perceptions of value, therefore, depend on the

effectiveness of a service, which is rooted in concepts such as usefulness (Davis 1989) and expected service performance (Venkatesh et al. 2003). The extent to which consumers perceive engaging with a service as effective is affected by a service provider's ability to transform the acquired personal information into a tailored and useful offer. That is to say, believing that the provider of the personalised service is able to transform personal information into effective personalisation assures consumers that engaging with a service will enable them to achieve their goal (Siegrist et al. 2005; Earle 2010). Therefore, service providers who prompt higher levels of perceived ability will be seen as suppliers of more effective services, which in turn will increase consumers' perception of personalisation benefit. Thus, we suggest that:

Hypothesis 3. *Perceived personalisation benefit increases as consumer perceptions of service effectiveness rise.*

Hypothesis 4. *Perceived service effectiveness increases as consumer perceptions of a service provider's ability rise.*

Privacy risk perceptions are determined by the extent to which consumers believe that privacy loss is likely to occur (Smith et al. 2011). Perceptions of likely privacy loss are reduced if consumers feel in control of which personal information is disclosed and how the disclosed information is being used (Phelps et al. 2000). Hence, information control mitigates perceived privacy risk by making consumers feel in control of the privacy risk they are exposed to (Margulis 2003). Consumer perceptions of information control result from the belief that a service provider is trustworthy, and consequently will not misuse the disclosed personal information. If consumers perceive a service provider to be a person of benevolence (i.e. wants to do good) and integrity (i.e. adheres to sound moral and ethical principles) in terms of his or her behavioural intentions, high perceptions of trustworthiness are in place (Colquitt et al. 2007). Therefore, service providers who induce high perceptions of benevolence and integrity are likely to increase consumer perceptions of information control and with that reduce consumer perceptions of privacy risk:

Hypothesis 5. *Perceived privacy risk decreases as perceived information control increases.*

Hypothesis 6. *Perceived information control increases as consumer perceptions of a service provider's benevolence rise.*

Hypothesis 7. *Perceived information control increases as consumer perceptions of a service provider's integrity rise.*

Both privacy risk and personalisation benefit perceptions are likely to depend on the personal information that is required for personalisation to take place. Based on the intimacy level and quantity of the disclosed information, service providers acquire a certain degree of knowledge about an individual's identity (Marx 1999), which they use to determine who their customer is. The more a service provider knows about an individual's identity, the more likely it becomes that personalisation will result in valuable benefits, but also the more severe the consequences of possible privacy loss (Wendel et al. 2013). The acquired identity knowledge may, after all, end up in the hands of unauthorised third parties and consequently be used for purposes other than originally intended. For example, a company that provides tailored dietary advice may sell all the knowledge it has acquired regarding an individual's identity to an insurance company. Consequently, we hypothesise that:

Hypothesis 8. *Both perceived personalisation benefit and perceived privacy risk increase as consumer perceptions of identity knowledge rise.*

The drivers behind consumer perceptions of ability, benevolence, integrity, and identity knowledge are the service attributes that shape the setting in which information disclosure takes place. When looking at personalisation from the perspective of an information exchange process (van Trijp and Ronteltap 2007), it becomes clear that the information disclosure setting is shaped by other service attributes than merely personal information. The information exchange process consists of three consecutive stages: 1) the consumer discloses personal information to a service provider; 2) the service provider uses the personal information to generate the personalised service; 3) the service provider provides the personalised service to the consumer (Ronteltap et al. 2013). Although personal information remains the at heart of personalisation, the information exchange process suggests that service attributes such as communication mode, service scope, and service frequency also contribute to the information disclosure setting. Consumers may for instance be reluctant to disclose unique

information to a service provider that limits himself to email communication (Metzger 2004) or perceive information disclosure as more valuable when recommendations are provided more than once (Seiders et al. 2014). Figure 1 shows the theoretical model of this study.

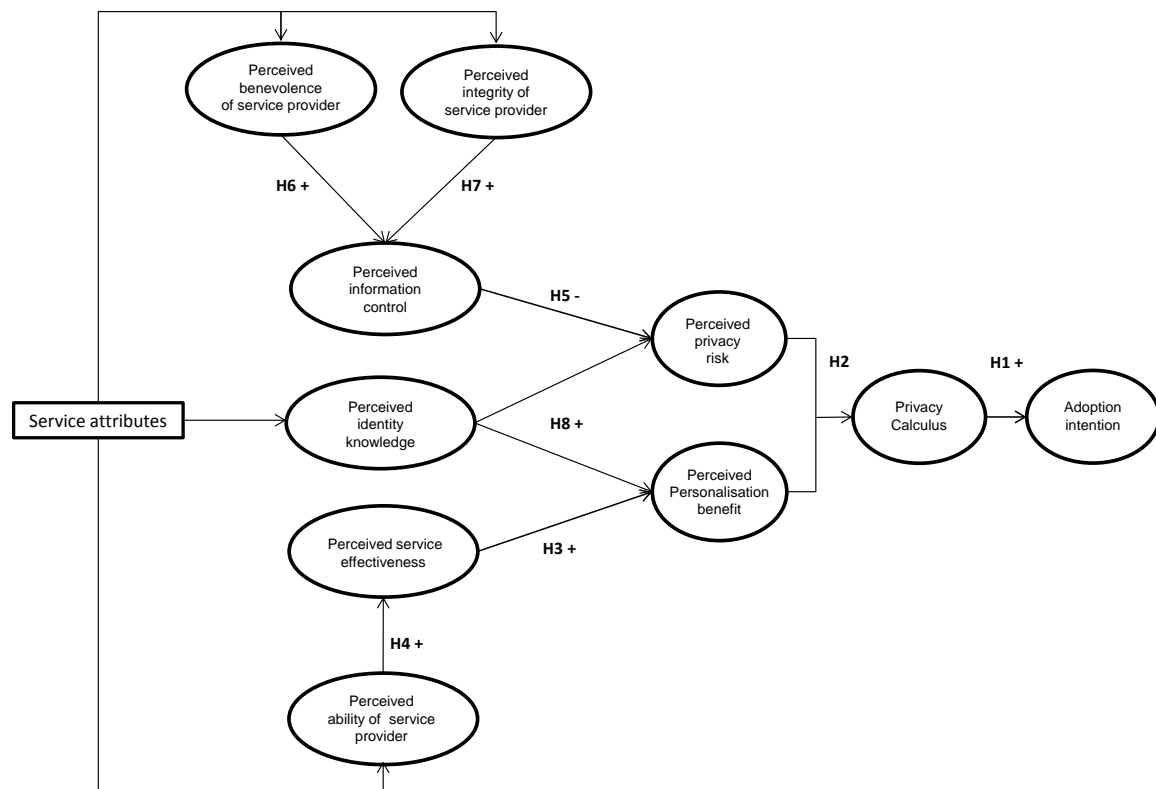


Figure 1. Theoretical model

METHODS

Sample and procedure

To test the theoretical model in the case of unique personal information, a total of 8136 participants from 8 European countries (Greece, Spain, the Netherlands, Ireland, UK, Germany, Poland, and Norway) participated in the study. To ensure nationally representative samples, participants were quota sampled based on their gender, age, region of residence, and highest level of education completed according to the International Standard Classification of Education (UNESCO Institute for Statistics 2012). Average age was 41 years and ranged from 18-65. The sample included 49.9% men. Of all participants, 29.9% enjoyed tertiary education, 40.5% obtained a upper-secondary or post-secondary education degree, and 30.5% completed lower- secondary education or less.

Participants were sampled from the panels of a market research agency (GfK) and invited to participate in the survey by email. Completion of the online survey took about 18 minutes. The overall response rate was 51%. To compensate for time and effort, participants were rewarded credits that accumulate to a gift voucher. Data were collected in November/December 2013.

Stimuli

Fictitious personalised nutrition services were used as stimulus material. A total of 144 services were generated using a full-factorial design consisting of the levels of five service attributes (4x Personal information, 3x Service provider, 2x Communication mode, 3x Advice scope, 2x Advice frequency) based on Berezowska et al. (2014) (Table 1). Each participant was shown two personalised nutrition services. To ensure intra-individual variance in the *Identity Knowledge* construct, the two personalised nutrition services contained different levels of personal information. Taking account of this condition, the first personalised nutrition service was assigned completely at random, while the second personalised nutrition service was assigned partially at random. For instance, if the first service required DNA, the second service had to require lifestyle information, blood, or the combination of blood and DNA. The service attribute levels of both personalised nutrition services were presented to the participants using pictograms supported by textual descriptions (Figure 2). To control for

assumptions regarding terms and conditions, participants were told that all services met the guidelines of the European Association of Dietitians (a non-existent organisation). Furthermore, to ensure an equal starting point and with that minimise noise, participants were instructed to imagine being in need of a service that could help them develop a healthier lifestyle.

Table 1. Personalised nutrition service attributes and levels

Service attribute	Service attribute levels
Personal information ¹	<ul style="list-style-type: none"> • <i>Low quantity private information:</i> Lifestyle² • <i>Mid quantity sensitive information:</i> Lifestyle + Blood • <i>Mid quantity unique information:</i> Lifestyle + DNA • <i>High quantity unique information:</i> Lifestyle + Blood + DNA
Service provider	<ul style="list-style-type: none"> • Consultancy + dietician • Fitness club + dietician • Employer + dietician
Communication mode	<ul style="list-style-type: none"> • No personal contact • Personal contact
Advice scope	<ul style="list-style-type: none"> • Nutrition advice • Nutrition advice + Exercise advice • Nutrition advice + Exercise advice + Group support meetings
Advice frequency	<ul style="list-style-type: none"> • One-off • Monthly

¹All services required contact details (name, address) and individual information (height, weight, gender, and age)

²Lifestyle = dietary intake, physical activity

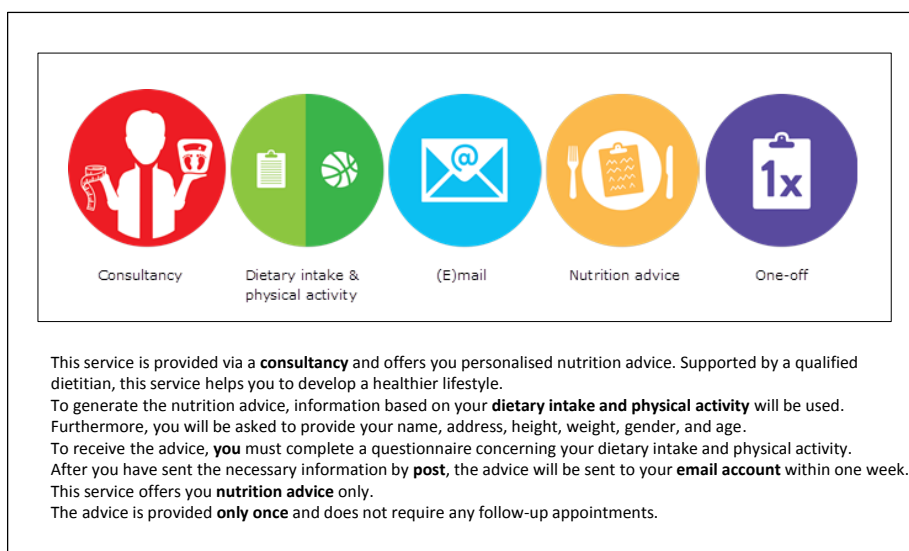


Figure 2. Representation of personalised nutrition service descriptions

Measures

Measures were derived from existing scales adapted from prior studies (Table 2). As no relevant *Identity Knowledge* scale was available, *Identity Knowledge* items were developed based on Zwick and Dholakia (2004). All items were answered on 7-point scales ranging from completely disagree to completely agree or, in case of the Privacy Calculus, greater risks to greater benefits. The survey was pre-tested during cognitive walkthrough interviews in the Netherlands ($N=12$). Based on the pre-test minor amendments related to the questionnaire's layout and comprehensiveness of the personalised nutrition service descriptions were made. To test the adequacy of the revised questionnaire, an online pilot study was conducted in the UK ($N=50$) and the Netherlands ($N=50$). The pilot study did not result in further amendments. Finally, the English questionnaire was translated and back-translated (Brislin 1970) into the national languages of the participating countries.

Data analysis

The model was tested using confirmatory factor analysis and structural equation modelling with maximum likelihood estimation in the R package Lavaan (Rosseel 2012). Model fit for both the measurement model and the structural models was assessed on four goodness of fit indices: 1) Root Mean Square Error of Approximation (RMSEA), good if $<.07$; 2) Standardized Root Mean Square Residual (SRMR), good if <0.08 ; 3) Comparative Fit Index (CFI), good if > 0.95 ; 4) Tucker-Lewis index (TLI), good if >0.95 . The adopted cut-off values were derived from Hair et al. (2010).

To rule out the possibility of language causing differences between countries, cross-national equivalence of the employed measures was established through multi-group confirmatory factor analysis; starting from individual latent constructs across countries. Equivalence of the employed measures was assessed on the basis of three consecutive tests proposed by Steenkamp and Baumgartner (1998): 1) Configural invariance, to check whether items of a particular measure load on the same construct in all countries; 2) Metric invariance, to check whether assigning the same factor loading to a particular item across countries is possible; 3) Scalar invariance, to check whether the average item responses were equal across countries. In case of unacceptable model fit, parameters related to configural, metric, and/or scalar invariance were relaxed based on the modification indices.

Table 2. Constructs, items, and scale reliability

Construct	Adapted from	Question	Items	Anchors
Adoption intention	(Zarpou et al. 2012)/(Kim and Park 2013)		<ul style="list-style-type: none"> I would consider using this service I intend to use this service I would recommend this service to others 	1 = "Strongly disagree" to 7= "Strongly agree"
Privacy calculus	(Xu et al. 2011)		<ul style="list-style-type: none"> All things considered, do you think using Service 1¹ will offer greater benefits than risks, or greater risks than benefits 	1 = "Greater risks" to 7= "Greater benefits"
Personalisation benefit	(Xu et al. 2009)	Compared to general nutrition advice, Service 1 offers me nutrition advice that is	<ul style="list-style-type: none"> more accurately tailored to my health needs more relevant for my health more beneficial for my health 	1 = "Strongly disagree" to 7= "Strongly agree"
Privacy risk	(Xu et al. 2009)	I think that using Service 1	<ul style="list-style-type: none"> involves many privacy-related risks is a threat to my privacy creates a high risk for the loss of my privacy 	1 = "Strongly disagree" to 7= "Strongly agree"
Identity knowledge	Developed based on (Zwick and Dholakia 2004)	The way in which Service 1 obtains my personal information results in	<ul style="list-style-type: none"> correct information accurate information detailed information 	1 = "Strongly disagree" to 7= "Strongly agree"
Service effectiveness	(Davis 1989) / (Venkatesh et al. 2003)	Service 1	<ul style="list-style-type: none"> enables me to develop a healthier lifestyle helps me to have a healthier lifestyle makes me feel in control of developing a healthier lifestyle 	1 = "Strongly disagree" to 7= "Strongly agree"
Information control	(Mothersbaugh et al. 2012)	The way in which Service 1 will use my personal information	<ul style="list-style-type: none"> is completely determined by me depends completely on me giving my approval is under my control 	1 = "Strongly disagree" to 7= "Strongly agree"
Ability of service provider	(Mayer and Davis 1999)	I think that the provider of Service 1	<ul style="list-style-type: none"> is very capable of providing personalised nutrition advice has much knowledge about personalised nutrition advice has the skills to provide personalised nutrition advice 	1 = "Strongly disagree" to 7= "Strongly agree"
Benevolence of service provider	(Mayer and Davis 1999)	I think that the provider of Service 1	<ul style="list-style-type: none"> is very concerned about my welfare will not knowingly do anything to hurt me looks out for what is important to me will go out of its way to help me 	1 = "Strongly disagree" to 7= "Strongly agree"
Integrity of service provider	(Mayer and Davis 1999)	I think that the provider of Service 1	<ul style="list-style-type: none"> sticks to its word tries to be fair in dealing with others is guided by sound principles 	1 = "Strongly disagree" to 7= "Strongly agree"

¹Service 1 was replaced with Service 2 when evaluating the second personalised nutrition service description

Internal consistency of the latent constructs was evaluated on the basis of two reliability checks: 1) ω^2 , adequate when >0.7 (Nunnally 1978); 2) average variance extracted (AVE), adequate when >0.5 (Fornell and Larcker 1981). To assess discriminant validity (i.e. the extent to which the measured constructs are distinct), the shared variation between a construct and its items (i.e. AVE) had to exceed the shared variance between that particular construct and each of the other constructs (Fornell and Larcker 1981).

To evaluate the main effects of the service attributes against their interactions, the individual cases ($N = 16,272$) were aggregated into 144 new cases representing each of the 144 personalised nutrition services. The aggregated data was analysed using Multivariate Analysis of Variance.

RESULTS

Measurement model

One-factor models that analysed each multi-item construct individually (Table 3) confirmed partial configural invariance for *Perceived benevolence of service provider*, meaning that its conceptual definition was similar across countries. Partial configural invariance for *Perceived benevolence of service provider* was reached by introducing error covariance between item 1 (concerned about welfare) and item 4 (goes out of its way to help). The error covariances ranged from 0.050 to 0.282. Configural invariance was not assessed for the remaining constructs given that, in the light of model identification, assessing configural invariance is only meaningful when construct scales consist of at least four items. Metric invariance for all multi-item constructs, except *Perceived benevolence of service provider*, was achieved, indicating that the latent variables have the same meaning in all countries. Partial metric invariance for *Perceived benevolence of service provider* was reached after relaxing the equality constrain for the error covariance between item 1 and item 4 in the case of Norway. Scalar invariance, showing equal response patterns across countries, was achieved for *Perceived integrity of service provider*, *Perceived ability of service provider*, *Perceived information control*, *Perceived identity knowledge*, *Perceived service effectiveness*, *Perceived privacy risk*, *Perceived personalisation benefit*. After relaxing some equality constraints (see Table 3), partial scalar invariance was obtained for *Perceived benevolence of service provider* and *Adoption intention*. After relaxing the relevant parameters, CFI, TLI, SRMR showed good fit for all constructs. The RMSEA indicated good fit for most constructs except *Perceived benevolence of service provider* (RMSEA = 0.079) and *Adoption intention* (RMSEA = 0.076). These RMSEA values could, however, be considered sufficiently close to good fit at this stage (Baumgartner and Homburg 1996).

Given that the Privacy Calculus was a single item construct, establishing configural, metric, and scalar invariance was irrelevant. Furthermore, measuring the Privacy Calculus with only one item made estimating the item's error variance impossible. To distribute variance between the latent variable and the item, the error variance of the single-item construct *Privacy Calculus* was set to 40%.

After establishing acceptable fit using one-factor models for each multi-item construct, all items were subjected to a scalar-invariant multi-factor model including all relaxations suggested by the one-factor models. As the CFI, TLI, RMSEA, and SRMR values for the measurement model indicated

good fit (Table 3), it can be assumed that despite the difference in language the measurement model is equal across all participating countries.

All constructs fulfilled the requirements for internal consistency. The ω^2 values ranged from 0.888 to 0.969. The AVE values ranged from 0.712 to 0.913. Discriminant validity was adequate across all constructs except *Benevolence of the service provide*. *Benevolence of the service provider* was not distinct from *Integrity of the service provider* in the case of Norway, Germany, Greece, Poland, and the Netherlands. Nevertheless, considering the 1) evidence for discriminant validity of the two constructs in the other countries, 2) confirmed discriminant validity taking *Integrity of the service provider* as the reference construct, and 3) almost identical values of the AVE (0.712-0.772) and the between construct variance (0.757-0.799), it was decided that *Benevolence of the service provider* and *Integrity of the service provider* should not be merged.

Table 3. Fit measures for the one-factor multi-item models and the overall measurement model

	Scalar invariance	Chi-square	Df	CFI	TLI	RMSEA			SRMR
						Value	90% LB	90% UB	
One-factor models									
<i>Adoption intention</i>	Partial ¹	344.92	27	0.992	0.992	0.076	0.069	0.083	0.030
<i>Personalisation benefit</i>	Yes	90.50	28	0.999	0.999	0.330	0.026	0.041	0.013
<i>Privacy risk</i>	Yes	208.01	28	0.997	0.99	0.056	0.048	0.063	0.018
<i>Identity knowledge</i>	Yes	219.54	28	0.996	0.996	0.058	0.051	0.065	0.027
<i>Service effectiveness</i>	Yes	79.57	28	0.999	0.999	0.030	0.022	0.028	0.010
<i>Information control</i>	Yes	275.22	28	0.994	0.995	0.066	0.059	0.073	0.034
<i>Ability of service provider</i>	Yes	107.63	28	0.999	0.999	0.037	0.030	0.045	0.011
<i>Benevolence of service provider</i>	Partial ²	692.80	51	0.988	0.988	0.079	0.074	0.084	0.048
<i>Integrity of service provider</i>	Yes	211.13	28	0.996	0.997	0.057	0.050	0.064	0.019
Overall measurement model	Partial ³	14264.38	2922	0.980	0.977	0.044	0.043	0.044	0.032

¹ Equality of item intercept relaxed for item 1 in Poland.

² Model includes error covariance between item 1 and item 4, which is equal across countries except Norway. Equality of item intercept relaxed for item 1 in Spain, Poland, and The Netherlands. Equality of item intercept relaxed for item 2 in Norway and Poland.

³ Including error covariance and intercept relaxations identified in the one-factor measurement models

Structural model

Starting from configural invariance of the structural relations, the theoretical model was tested in six consecutive steps that consecutively added equality constraints across countries: Step 1) configural structural invariance across countries including covariances between *Ability*, *Benevolence*, *Integrity*, and *Identity Knowledge*; Step 2) equal path coefficients across countries; Step 3) equal variances and covariances among *Ability*, *Benevolence*, *Integrity*, and *Identity Knowledge*; Step 4) equal regression intercepts for *Information control*, *Effectiveness*, *Privacy Risk*, *Personalisation Benefit*, *Privacy Calculus*, and *Adoption Intention*; Step 5) equal means for *Ability*, *Benevolence*, *Integrity*, and *Identity Knowledge*; Step 6) equal R^2 (i.e. disturbance terms). Table 4 shows the fit measures for these six steps. Although most fit measures met the proposed cut-off values, the SRMR values were slightly higher than the recommended cut-off criterion. As adding relations would diminish the parsimony of our model and introduce empirically determined rather than theoretical relations, it was decided to not further adjust the model.

Correlations between *Ability of service provider*, *Benevolence of service provider*, *Integrity of service provider* and *Identity Knowledge* were high and ranged from 0.64 to 0.87 ($p < 0.001$).

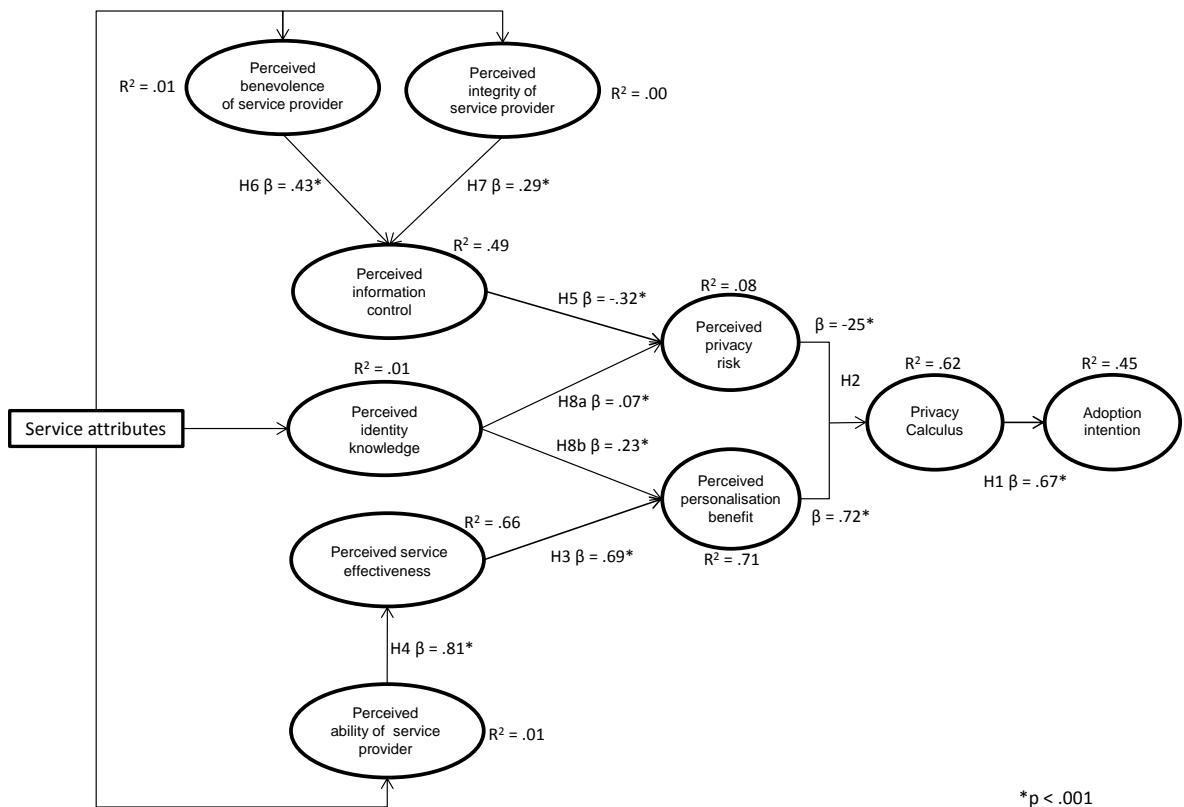
Table 4. Fit measures for the six steps of the structural equation model using country as grouping variable

Model	Chi-square	Df	CFI	TLI	RMSEA			SRMR
					Value	90% LB	90% UB	
1. Configural structural Invariance	25870.22	4954	0.962	0.959	0.046	0.045	0.046	0.077
2. Equal path coefficients	26675.94	5276	0.961	0.961	0.045	0.044	0.045	0.081
3. Equal (co-) variances among <i>Ability</i> , <i>Benevolence</i> , <i>Integrity</i> , <i>Identity Knowledge</i>	27383.49	5346	0.960	0.960	0.045	0.044	0.046	0.091
4. Equal regression intercepts	28405.79	5381	0.958	0.959	0.046	0.045	0.046	0.089
5. Equal means <i>Ability</i> , <i>Benevolence</i> , <i>Integrity</i> , <i>Identity Knowledge</i>	28842.03	5409	0.958	0.958	0.046	0.046	0.047	0.090
6. Equal R^2	29764.83	5451	0.956	0.957	0.047	0.046	0.047	0.092

Hypothesis testing

Figure 3 shows the standardised path coefficients and proportions of explained variance for the final structural model. The standardized path coefficients of the different service attribute levels are shown in table 5. Due to the imposed equality constraints, both the path coefficients and the proportions of explained variance are identical for all countries.

The model supports all hypothesised relations and explains a considerable proportion of variance ($R^2 \geq 0.45$) for perceived *Information control*, *Effectiveness*, *Personalisation Benefit*, *Privacy Calculus*, and *Adoption Intention*. In the case of perceived *Privacy Risk* the model accounted for a modest proportion of explained variance ($R^2 = 0.08$). The explained variance for perceived *Ability of service provider*, *Benevolence of service provider*, *Integrity of service provider*, and *Identity Knowledge* was low ($R^2 \leq 0.01$).



*p < .001

Figure 3. Final structural model

Table 5. Path coefficients of service attribute levels

Service attribute	Construct			
	Ability of service provider	Benevolence of service provider	Integrity of service provider	Identity knowledge
Personal information				
Blood (compared to lifestyle)	0.016	0.003	0.006	0.044*
DNA (compared to lifestyle)	-0.035	-0.064**	-0.085***	0.045*
Blood x DNA (compared to lifestyle)	0.006	-0.049*	-0.056*	0.080***
Service provider				
Fitness club (compared to consultancy)	-0.005	0.067**	0.047*	-0.005
Employer (compared to consultancy)	-0.031	-0.052*	-0.011	-0.012
Communication mode				
Personal contact (compared to no personal contact)	0.130***	0.109***	0.089***	0.114***
Advice scope				
Nutrition + exercise (compared to nutrition only)	0.021	0.053**	0.022	0.015
Nutrition + exercise + support group (compared to nutrition only)	-0.002	0.024	0.011	0.012
Advice frequency				
Monthly (compared to one-off)	0.058***	0.050**	0.029	0.047**

p < 0.05 * p < 0.01 ** p < 0.001***

The final structural model indicates that the more positive the outcome of the *Privacy Calculus* the higher participants' *Intention to Adopt* personalised services (H1). The outcome of the *Privacy Calculus* was depending on both *Privacy Risk* and *Personalisation Benefit* perceptions (H2). Compared to the path coefficient of *Privacy Risk* (-0.25), the path coefficient of *Personalisation Benefit* (0.72) was almost three times as high. In addition, perceived *Privacy Risk* had a negative effect on the outcome of the *Privacy Calculus*, while perceived *Personalisation Benefit* was positively related to the *Privacy Calculus* outcome.

Perceived *Privacy Risk* was affected by both perceived *Identity Knowledge* (H8a) and perceived *Information Control* (H5). The relation between *Identity Knowledge* and perceived *Privacy Risk* was positive, indicating that an increase in *Identity Knowledge* caused an increase in the perception of *Privacy Risk*. The influence of perceived *Identity Knowledge* on perceived *Privacy Risk* was, however, minor (0.07). In the case of perceived *Information Control*, participants' perception of *Privacy Risk* rose as perception of *Information Control* increased. Perceived *Information Control* was determined by both perceived *Benevolence of the service provider* (H6) and perceived *Integrity of the service provider* (H7). An increase in both *Benevolence* and *Integrity* enhanced participants' perceptions of *Information Control*.

Perceived *Personalisation Benefit* depended on participants' perceptions of *Service Effectiveness* (H3) and *Identity Knowledge* (H8b). Perceived *Service Effectiveness* and perceived *Identity Knowledge* were positively related to perceived *Personalisation Benefit*, meaning that an increase in both *Service Effectiveness* and *Identity Knowledge* results in higher perceptions of *Personalisation Benefit*. Comparing the path coefficients of perceived *Service Effectiveness* (0.69) and perceived *Identity Knowledge* (0.23), the effect of perceived *Service Effectiveness* on perceived *Personalisation Benefit* was three times as high. Perceived *Service Effectiveness* depended on the perceived *Ability of the service provider* (H4). As the perceived *Ability of the service provider* rose so did participants' perceptions of *Service Effectiveness*.

Service attributes

Of all service attributes, aggregated data showed that *Personal Information*, *Service Provider*, and *Communication Mode* had an effect on *Adoption Intention*. The outcome of the *Privacy Calculus* was affected by all service attributes except *Advice Scope*. Perceptions of *Privacy Risk* were induced by *Personal Information* and the *Service Provider*. Disclosing unique information (i.e. DNA) and services offered by an employer were perceived as most risky, whereas private information (i.e. lifestyle) and services offered by a fitness clubs were perceived as least risky. Perceived *Personalisation Benefit* resulted from the service attributes *Advice Scope*, *Advice Frequency*, and *Service Provider*. Nutrition and exercise advice that was offered on a monthly basis by a fitness club was perceived as most beneficial. Communicating by means of personal contact had a positive effect

on the *Privacy Calculus* and *Adoption Intention* as it reduced *Privacy Risk* perceptions and increased *Personalisation Benefit* perceptions (Table 6).

Table 6. Estimated Marginal Means of the service attribute levels for Privacy Risk, Personalisation Benefit, Privacy Calculus, and Adoption Intention

Service attribute	Construct			
	Privacy Risk	Personalisation Benefit	Privacy Calculus	Adoption Intention
Personal information				
<i>Lifestyle</i>	3.86 ^a	4.70	4.74 ^b	4.19 ^c
<i>Blood</i>	3.97 ^b	4.71	4.73 ^b	4.17 ^{bc}
<i>DNA</i>	4.16 ^c	4.65	4.61 ^a	4.01 ^a
<i>Blood x DNA</i>	4.15 ^c	4.69	4.60 ^a	4.09 ^{ab}
Service provider				
<i>Consultancy</i>	3.98 ^a	4.68 ^{ab}	4.67 ^b	4.05 ^a
<i>Fitness club</i>	3.91 ^b	4.73 ^b	4.79 ^c	4.19 ^b
<i>Employer</i>	4.22 ^c	4.65 ^a	4.55 ^a	4.10 ^a
Communication mode				
<i>No personal contact</i>	4.12 ^a	4.60 ^a	4.57 ^a	4.06 ^a
<i>Personal contact</i>	3.95 ^b	4.77 ^b	4.77 ^b	4.17 ^b
Advice scope				
<i>Nutrition</i>	4.04	4.66 ^a	4.65	4.10
<i>Nutrition + exercise</i>	4.01	4.73 ^b	4.70	4.15
<i>Nutrition + exercise + support group</i>	4.06	4.67 ^a	4.66	4.09
Advice frequency				
<i>One-off</i>	4.01	4.65 ^a	4.63 ^a	4.11
<i>Monthly</i>	4.06	4.73 ^b	4.71 ^b	4.12

Note: Within a particular construct, means sharing the same superscript are not significantly different from the other levels of the same service attribute at $p < .05$ Tukey HSD.

DISCUSSION

This study contributes to the understanding of how the Privacy Calculus affects consumers' intention to adopt personalised services that require unique personal information. All hypothesised relations were supported and can be generalised across 8 EU countries. The hypothesised relations being significant and equal across countries points towards a robust and EU-wide applicable cognitive model that predicts consumers' intention to adopt personalised services.

Consumers' *intention to adopt* personalised services is shown to be determined by the *Privacy Calculus*. The *Privacy Calculus* depends more on consumer perceptions of *Personalisation Benefit* than on perceptions of *Privacy Risk*. It may even be the case that when the benefits offered by a service are perceived as too low, consumers will reject the service without considering its risks. This implies that the presence of attractive benefits is non-compensatory in determining consumers' intention to adopt personalised services. Further evidence for this claim should be provided by future studies. It should be noted that the *Privacy Calculus* was measured in terms of consumers' general risk and benefit perception, which may have instigated the dominant role of *Personalisation Benefit* perceptions. That is, in addition to privacy risk, general risk may comprise other types of risk such as performance or financial risk (van Trijp and Ronteltap 2007; Lee 2009). General benefit and personalisation benefit are, however, alike (van Trijp and Ronteltap 2007; Lee 2009). *Personalisation Benefit* being more comprehensive than *Privacy Risk* may have elevated its contribution to the *Privacy Calculus*. Although, the dominant role of perceived *Personalisation Benefit* is consistent with prior research (Xu et al. 2011), it might be worthwhile for future research to include comprehensive risk perceptions by systematically investigating the influence of different types of risk (Lee 2009).

Consumer perceptions of *Personalisation Benefit* were determined by both perceived *Service Effectiveness* and perceived *Identity Knowledge* (i.e. the extensiveness of the disclosed personal information). The effect of perceived *Identity Knowledge* on perceived *Personalisation Benefit* was, however, much smaller than the effect of perceived *Service Effectiveness*. For personalisation to be perceived as beneficial, companies should focus on providing services that promote goal attainment (Price et al. 2013) rather than collecting extensive amounts of intimate personal information to provide more advanced levels of personalisation. Since increasingly intimate personal information did not result in higher perception of *Personalisation Benefit*, but did increase perceptions of *Privacy Risk*, it is

likely that merely requiring more intimate information for the purpose of personalisation will not secure the adoption of personalised services.

In line with the work of Slovic (Slovic 2010), perceptions of *Privacy Risk* were mainly influenced by the extent to which consumers feel in control of their personal information and with that, are equipped to limit potential privacy risks. Hence, increasing perceptions of information control provides an opportunity to mitigate consumers' most important privacy concern in the form of unauthorised secondary use of information (i.e. service providers trading, selling, and/or sharing personal information with third parties) (Anton et al. 2010). The large proportion of unexplained variance in the *Privacy Risk* construct may be explained by the fact that this study focussed on privacy risk determinants related to information exchange, and as a consequence disregarded privacy risk determinants related to information management (Hong and Thong 2013). Especially in the context of secret services and hackers gaining access to computer based personal information, information management related privacy concerns such as improper access due to inadequate information storage security may provide better insights in consumers' *Privacy Risk* perception (Smith et al. 1996; Zhou 2011; Cortese and Lustria 2012). Future research should aim to compensate by taking into account both information exchange and information management related determinants of *Privacy Risk*.

Perceived ability of the service provider (i.e. competence) had a large effect on perceived *Service Effectiveness* and through that on consumer perceptions of *Personalisation Benefit*. Furthermore, *Perceived benevolence* and *integrity of the service provider* (i.e. reliability) influenced perceived *Information Control* and through that perceived *Privacy Risk*. Ability, integrity and benevolence are dimensions of trust (Mayer and Davis 1999). In the current analysis we followed the idea that the each trust dimensions has a distinct contribution to the decision process (Terwel et al. 2009). That is, competence-related trust dimensions may be associated with consumers' confidence in service effectiveness (Siegrist et al. 2005; Earle 2010), while reliability-related trust dimensions may be linked to social-trust that comprises the belief whether service providers can be relied on when it comes to having control over personal information (Earle and Cvetkovich 1995). Although treating the trust dimensions as distinct constructs shows good fit, the fact that they were highly correlated indicates that viewing trust as a single multidimensional construct (Siegrist et al. 2005) cannot be

dismissed. Whether the trust dimensions should be treated as a single or a number of distinct constructs remains a topic for future research.

Even though the contribution of most service attributes was significant and the direction of all effects was as expected, it should be kept in mind that the contribution of the service attributes was small. A possible explanation for this small effect may lie in the hypothetical nature of this study (Hofstetter et al. 2013). Participants not really being in need of personalised nutrition or the fact that intention to engage with a personalised nutrition service was not binding may have inhibited participants from taking a closer look at the attributes of the different personalised nutrition services. As a result, participants' opinions may have been guided by general ideas about a personalised nutrition service rather than the specific service description. In situations where the decision to engage with a personalised nutrition service is no longer hypothetical, service attributes are likely to play a much bigger role than would be expected on the basis of the current findings (Trope and Liberman 2010)

CONCLUSION

This study confirmed a robust and Europe-wide applicable cognitive model showing how the *Privacy Calculus* and its antecedents determine consumers' intention to adopt personalised services. For theory the model implies that consumers' intention to adopt personalised services depends more on perceptions of personalisation benefits than on perceptions of privacy risks. Putting this theoretical implication into practice would mean that to consolidate the adoption of personalised services, service providers should make sure that consumers perceive engaging in personalisation as beneficial. Increasing consumer perceptions of personalisation benefit should materialise by enhancing service effectiveness. Hence, to be successful, personalised services do not only have to exceed the benefits offered by similar not personalised services, but also make sure that consumer perceive engaging in a personalised service as something that contributes to goal attainment. Finally, consumers will only be willing to adopt personalised services if they perceive a service provider to be competent and reliable.

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