

HEALTH INFORMATION

Health in exchange for privacy:
The adoption of personalised nutrition advice

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Thesis

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General introduction

1.1. Setting the scene

Strategies that guide dietary behaviour are developed and implemented in order to control the high prevalence of non-communicable diseases triggered by unhealthy dietary choices associated with excessive salt, sugar, and fat intake (Arena et al., 2015; Lim et al., 2013). Such strategies are particularly relevant for Europe, which has the highest prevalence of non-communicable diseases (WHO, 2014). Due to low birth rates and increased longevity, Europe's population is aging (Eurostat, 2011b). As elderly are more prone to develop non-communicable diseases (Fortin, Bravo, Hudon, Vanasse, & Lapointe, 2005; Lehnert et al., 2011), an aging population increases the need for health care and consequently raises health care spending. The uneven distribution between old and young makes it increasingly difficult to ensure good health care and at the same time carry its financial load. Hence, guiding the dietary behaviour of European citizens is relevant not only from the perspective of wellbeing, but also from an economic point of view. When guiding the dietary behaviour of European citizens attention must be paid to country differences, as such differences may affect how the population of a given country deals with health (Adler & Newman, 2002; Alvarez-Galvez et al., 2013). The best way to reduce the prevalence of non-communicable diseases may, therefore, vary from country to country.

1.2. Food choice guidance strategies

Strategies that guide dietary behaviour generally revolve around education, law, and marketing (Rothschild, 1999). Educational strategies aim to stimulate healthy food choices through knowledge without reinforcing compliance. Examples of such strategies are food pyramids or 'plates' that show the recommended intake for specific food groups (e.g. Hess, Visschers, & Siegrist, 2012), mass media health campaigns (e.g. Beaudoin, Fernandez, Wall, & Farley, 2007), health education at schools (Mihas et al., 2010), and symbols on food products that make individuals aware of their nutritional value (e.g. Variyam, 2008). Legal strategies mandate changes in market conditions that leave individuals no other choice than to act in accordance with the proposed health intervention. Legislation that limits the amount of trans-fat in food products (L'Abbé, Stender, Skeaff, & Tavella, 2009), regulation of school meals (Eagle, 2009), subsidies on healthy foods (Cash, Sunding, & Zilberman, 2005), and taxes on unhealthy foods (Allais, Bertail, & Nichèle, 2010) are examples of law-related strategies. Marketing strategies stimulate compliance without mandating changes in the market place or relying on the provision of knowledge. To guide dietary behaviour, marketing strategies often focus on product placement (i.e. making low calorie products more visible and easier to reach than high calorie products) and product replacement (i.e. offering alternatives for high calorie products) (Bos, Van Der Lans, Van Rijnsoever, & van Trijp, 2013).

Although all of the abovementioned strategies stimulate healthy dietary behaviour, their effectiveness may be limited as they target populations as a whole rather than specific individuals. It is well established that tailoring health interventions to the needs and wants of specific individuals not only results in the most relevant interventions, but also stimulates the adoption of (Wright, Sherriff, Dhaliwal, & Mamo, 2011), adherence to (Berry, Michas, & Bersellini, 2003), and involvement in (Cortese & Lustria, 2012; Hurlimann et al., 2014; Lustria, Cortese, Noar, & Glueckauf, 2009) these interventions. These findings make it likely that tailoring increases the effectiveness of health interventions (Brug, Oenema, & Campbell, 2003; Kreuter & Wray, 2003; Noar, Benac, & Harris, 2007), and consequently generates higher levels of behavioural change. Tailoring health interventions to the individual is part of a broader trend towards individualised health care (Godman et al., 2013; Rigby, 2012; Snyderman, 2011). The current thesis fits this trend as it investigates how tailoring dietary recommendations and services that provide these recommendations affects individuals' intention to adopt strategies that guide dietary behaviour.

1.2.1. Tailored dietary recommendations

As individuals differ with regard to their nutritional needs (German, Zivkovic, Dallas, & Smilowitz, 2011), nutritional intake recommendations are tailored to specific population segments such as particular age groups (e.g. children, adults, elderly) and individuals with certain bodily conditions (e.g. pregnant women, diabetics) (Bouchard & Ordovas, 2012; Joost et al., 2007). Although providing nutritional intake recommendations to specific segments of the population accounts for individual differences within a population to some extent, recent technological developments (Lewis & Burton-Freeman, 2010; Nielsen & El-Sohemy, 2012) make it possible to further specify nutrition recommendations by tailoring them to individuals rather than segments within the population. In the realm of food choice guidance this concept is called personalised nutrition (Kussmann & Fay, 2008).

Personalised nutrition differs from the traditional way of food choice guidance as its messages and/or strategies are intended for one particular person (instead of a group) and are based on personal information obtained through individual diagnostic assessments (Bouwman, te Molder, Koelen, & van Woerkum, 2009). The most basic form of personalised nutrition is nutritional advice that is tailored on the basis of lifestyle information (e.g. dietary habits, dietary intake, physical activity) (Gibney & Walsh, 2013). To provide a more detailed nutrition advice, in addition to lifestyle information personalised nutrition can also be tailored based on an individual's phenotype (e.g. BMI, blood chemistry). The completion of the "Human Genome Project" and technological advances in the field of Genomics, Transcriptomics, Proteomics and Metabolomics (Fenech et al., 2011; García-Cañas, Simó, León, & Cifuentes, 2010; J. Little & Hawken, 2010) make it possible to take lifestyle and phenotype based personalised nutrition one step further. More specifically, these technological advances allow nutritional recommendations to be tailored

to individuals' genetic make-up. This type of personalised nutrition is associated with the field of Nutritional Genomics, which studies the effect of nutrients on gene expression (i.e. nutrigenomics) and the effect of genes on the response to nutrient (i.e. nutrigenetics) (Farhud, Yeganeh, & Yeganeh, 2010). Hence, in its most advanced form personalised nutrition aims to increase health through dietary advice that is tailored to suit individuals based on their lifestyle, phenotype, and/or genetics.

1.2.2. Tailored services

Although personalised nutrition advice in its most advanced form is already being marketed, the success of the services that offer such advice is limited (Saukko, 2013; Saukko, Reed, Britten, & Hogarth, 2010). A possible reason for this limited success may be that the current personalised nutrition services do not meet the needs and wants of potential consumers, which makes engaging with these services not or less worthwhile. Tailoring personalised nutrition services to the needs of potential consumers provides an opportunity to increase individuals' intention to engage in personalised nutrition, as tailored products and services provide superior value to consumers (Simonson, 2005) and consequently yield more satisfaction and loyalty (Fan & Poole, 2006; Sunikka & Bragge, 2008; Wu, 2011). It is likely that individuals' needs regarding the services that offer personalised nutrition advice come in many shapes and sizes (Stewart-Knox et al., 2013). Hence, to be able to tailor personalised nutrition services to the needs of individual consumers, knowledge about these needs is required. Such knowledge is, however, scarce. To provide insight into individuals' needs with regard to personalised nutrition services, this thesis explores which services are currently available in the market place and identifies how the attributes of these services affect individuals' intention to engage in personalised nutrition.

1.3. Adoption of personalised nutrition advice

Compared to population-based nutritional recommendations, personalised nutrition advice provides individuals with detailed and highly relevant dietary recommendations. Due to these benefits expectations regarding the application of the personalised approach to dietary advice are sky-high (Afman & Müller, 2006; Joost et al., 2007; Stover & Caudill, 2008). Some even argue that this approach holds the potential to revolutionise health care, health promotion and the food market (Stewart-Knox et al., 2009). Nevertheless, for this revolutionising effect to occur individuals must be willing to engage in personalised nutrition. Hence, the success or failure of personalised nutrition depends on individuals' intention to adopt the dietary advice that results from it.

Adoption intention is likely to be determined by the extent to which individuals perceive personalised nutrition as relevant and beneficial. The relevance of a personalised nutrition advice increases as the information on which it is based becomes more personal, detailed, and specific (van Trijp & Ronteltap, 2007). Receiving highly relevant and beneficial dietary recommendations, therefore, requires willingness to disclose highly personal and potentially sensitive health information. Disclosure of sensitive personal information may prevent individuals from adopting personalised nutrition advice, as after disclosure such information may be sold to for instance insurance companies or employers (Bansal, Zahedi, & Gefen, 2010) who use it for unintended purposes such as job or insurance screening. Hence, disclosure of sensitive personal information triggers the potential risk of privacy loss (Mothersbaugh, Foxx, Beatty, & Wang, 2012), which may decrease individuals' intention to adopt personalised nutrition advice.

Perceived privacy risk is associated with an individual's ability to control personal information (Belanger & Crossler, 2011). This ability applies both to being able to decide which personal information one wants to disclose and to staying in charge of personal information after its disclosure (Acquisti, Brandimarte, & Loewenstein, 2015). Privacy laws (Buschel, Mehdi, Cammilleri, Marzouki, & Elger, 2014) and policies (Noblin, 2007) have been established to increase individuals' ability to control personal information and in that way protect these individuals from the risk of privacy loss. Although privacy laws and policies give individuals a clear idea on how their personal information will be managed after disclosure and who will be able to access it, privacy laws and policies cannot guarantee that the disclosed information will stay out of the hands of unauthorised third parties. Hence, even if information is stored correctly and security measures are in place, individuals continue to have privacy concerns (Anton, Earp, & Young, 2010) which makes them consider potential privacy risks (Kehr, Kowatsch, Wentzel, & Fleisch, 2015; H. Li, Gupta, Zhang, & Sarathy, 2014) when adopting personalised nutrition advice.

Despite the potential risk of privacy loss, when perceived privacy risk is outweighed by the benefits that result from information disclosure individuals are likely to accept these risks (Y. Li, 2012), which increases their willingness to disclose personal information (e.g. Belanger & Crossler, 2011; Pavlou, 2011; Smith, Dinev, & Xu, 2011). This suggests that before the adoption of personalised nutrition advice takes place, individuals have to assess whether the potential risks of information disclosure are sufficiently offset by its potential benefits. This type of risk-benefit trade-off is framed as a privacy calculus (Culnan & Armstrong, 1999), which assumes that individuals behave in ways that maximise positive outcomes and minimise negative outcomes. When the balance between personalisation benefits and privacy risks is positive (i.e. perceived benefits exceed perceived risks) and perceived as acceptable, individuals' willingness to disclose personal information is likely to increase. An increased willingness to disclose personal information, in turn, may increase individuals' intention to engage with a personalised nutrition service and consequently lead to the adoption of personalised nutrition advice. A risk-benefit balance in which

perceptions of personalisation benefit are lower than perceptions of privacy risk is likely to be experienced as unacceptable, and as a result decrease individuals' willingness to disclose personal information. A decreased willingness to disclose personal information may be detrimental to individuals' intention to engage with a personalised nutrition service and most likely lead to the rejection of personalised nutrition advice.

Although the privacy calculus is relevant for health care applications such as personalised nutrition advice, to date most privacy calculus studies are published in the Information Science and Systems literature, which revolves around e-commerce and social media (Table 1.1). As these applications are not health related, and rely on other types of personal information, current insights regarding the privacy calculus may not fully fit the health context, which suggests the need for adaptation and additional research. Moreover, the current privacy calculus literature pays little attention to factors that determine perceptions of privacy risk and personalisation benefit. At present, only a few privacy calculus studies report determinants of risk and benefit perceptions (Table 1.1), which makes the role and contribution of these determinants uncertain. Studying the privacy calculus and its determinants may therefore help to better understand how to best stimulate the adoption of personalised nutrition advice. The current thesis will investigate factors that drive individuals' perceptions of privacy risk and personalisation benefit, and determine how these perceptions contribute to individuals' intention to adopt personalised nutrition advice.

1.4. The effect of self-regulation on adoption intention

The extent to which adoption intention is predicted by its determinants differs between individuals (e.g. T. W. Andreassen & Streukens, 2013; Cho & Park, 2014; G. X. Li, Zhang, & Wang, 2015). Among others, these individual differences may result from the different ways in which people control and adjust their behaviour in order to attain personal goals. The ways in which individuals control and adjust their behaviour are generally referred to as self-regulation processes (Vohs & Baumeister, 2013). Self-regulation processes concern inner states (i.e. thoughts and feelings) or actions (Zimmerman, 2005) that determine why and how individuals regulate their behaviour in order to achieve a personal goal. Individuals can for instance differ in the way they regulate their behaviour because they are either convinced that attaining a particular goal is very important to them (i.e. autonomous inner state), or because they feel forced to attain a goal (i.e. controlled inner state). Which of the two inner states is dominant depends on individuals' self-determination (Deci & Ryan, 2000; Ryan & Deci, 2000). Furthermore, self-regulation processes can differ between individuals depending on whether people tend to attain goals through actions that prevent negative outcomes or through actions that promote positive outcomes.

Table 1.1. Overview of contexts and constructs studied in privacy calculus research

Author	Context	Core mechanism			Evaluation criteria of risk-benefit balance				Determinants ¹	
		Privacy calculus	Privacy risk	Benefits	Trust	Information control	Information sensitivity	Emotion		
Anderson, 2011	Health records				X			X		
Catoiu, 2014	Social media		X	X*	X					
Cheung, 2015	Social media		X		X*	X*				X
Dinev, 2006	E-commerce		X		X					
Dinev, 2006	E-commerce		X		X					
Dinev, 2008	Surveillance									
Dinev, 2013	Social media		X	X*		X	X*			
Frost, 2014	E-health									
Hu, 2015	Social media		X	X						
Jiang, 2013	Social media									
Kehr, 2015	Apps		X	X*	X [†]		X* [†]			X
Keith, 2013	E-commerce		X	X						
Krasnova, 2010	Social media		X		X*	X*				X
Krasnova, 2012	Social media				X					X
Li, 2010	E-commerce		X							
Li, 2011	E-commerce		X				X			X*
Li, 2014	Health records		X	X	X* [†]	X* [†]				
Morosan, 2015	E-commerce	X	X	X	X					X
Shibchurn, 2015	Social media		X							
Sun, 2015	E-commerce		X	X						
Wang, 2014	E-commerce									
Xu, 2011	E-commerce	X	X	X						
Xu, 2009	E-commerce		X	X						
Xu, 2013	Social media		X	X		X	X			
Zhao, 2012	E-commerce			X		X				

Note: The studies were selected based on the keyword "privacy calculus" that had to occur in the keywords, abstract, and/or title of the study. Conference papers, studies that were not written in English, and studies that did not test a conceptual framework were omitted. The overview was compiled in November 2015 using the database Web of Science.

¹Only determinants that were mentioned at least three times are included in the overview

*Proximal determinant of privacy risk [†]Proximal determinant of benefit

The extent to which individuals focus on either promotion or prevention depends on their regulatory focus (Gomez, Borges, & Pechmann, 2013; Higgins, 1997). This thesis accounts for individual differences associated with either self-determination or regulatory focus. Investigating both self-determination and regulatory focus will allow to identify how anticipated conditions influence the cognitive process that determines individuals' intention to adopt personalised nutrition, and consequently provide additional insight into how to best stimulate adoption intention.

1.5. Thesis outline

The central research question of this thesis is:

What determines the trade-off between privacy risk and personalisation benefits in the context of personalised nutrition advice?

The answer to the central research question is provided through three research lines. The first research line revolves around the sub question:

How does service design affect the risk-benefit trade-off?

Chapter 2 presents an overview of personalised nutrition services that are currently available in the market place. Using the framework of Osterwalder and Pigneur (2010) the identified services were classified based on their main customer segment, value proposition, channel, customer relationship, revenue stream, resources, activities, partnerships, and cost structures. Building on the obtained classification, archetypical personalised nutrition services and attributes in the form of communication channels, required personal information, service providers, advice justification, advice scope, and advice frequency were extracted. *Chapter 3* explores which service attributes of the archetypical personalised nutrition services identified in *Chapter 2* are relevant for individuals' perceptions of privacy risk and personalisation benefit. To do so focus group discussions in which participants from eight European countries evaluated fictitious personalised nutrition services were conducted. Based on these evaluations, *Chapter 3* also proposes cognitive determinants that form the foundation for individuals' perceptions of privacy risk and personalisation benefit.

Building on the results of the first research line, the second research line answers the sub question:

What is the cognitive process behind the risk-benefit trade-off and does this process differ depending on country differences?

Chapter 4 contributes to the answer to this question by quantifying the results of *Chapter 3* in eight European countries. To allow for quantification and simultaneously account for country differences, a cross sectional survey was conducted using population samples that were demographically representative of each country in terms of age, gender, education, and region of residence. A multi-group structural equation model was used to determine whether the cognitive process that drives individuals' intention to adopt personalised nutrition is affected by country differences.

Building on the outcomes of the second research line, the third research line answers the question:

How is the cognitive process that drives the risk-benefit trade-off affected by self-regulation?

In addition to country differences, individual differences related to self-regulation may also affect the cognitive process that drives individuals' intention to adopt personalised nutrition advice. *Chapter 5* reports how differences in individuals' self-determination affect this cognitive process. Distinguishing between high and low levels of autonomous and controlled motivation to eat healthily, *Chapter 5* investigates how four motivational orientations moderate the cognitive process that was established in *Chapter 4*. To determine the effect of self-determination on the cognitive process, data collected in *Chapter 4* is subjected to secondary analysis. *Chapter 6* focuses on how an individual's regulatory focus contributes to the cognitive process that leads to the adoption of personalised nutrition advice. In addition, *Chapter 6* examines the link between regulatory focus and individuals' preference for temporal distance. The effect of regulatory focus and its link to temporal distance is examined in an experimental setting in which both regulatory focus and temporal distance are manipulated.

Chapter 7 concludes the thesis and shows that, independent of nationality, individuals' intention to adopt personalised nutrition advice is best stimulated through perceptions of personalisation benefit. In addition, to maximise adoption intention for now it seems best to base personalised nutrition advice on lifestyle and phenotypic information. Next to an overall discussion of the results and implications, *Chapter 7* also reflects on the limitations of the conducted research and provides suggestions for future studies. Figure 1.1 provides a schematic outline of the thesis.

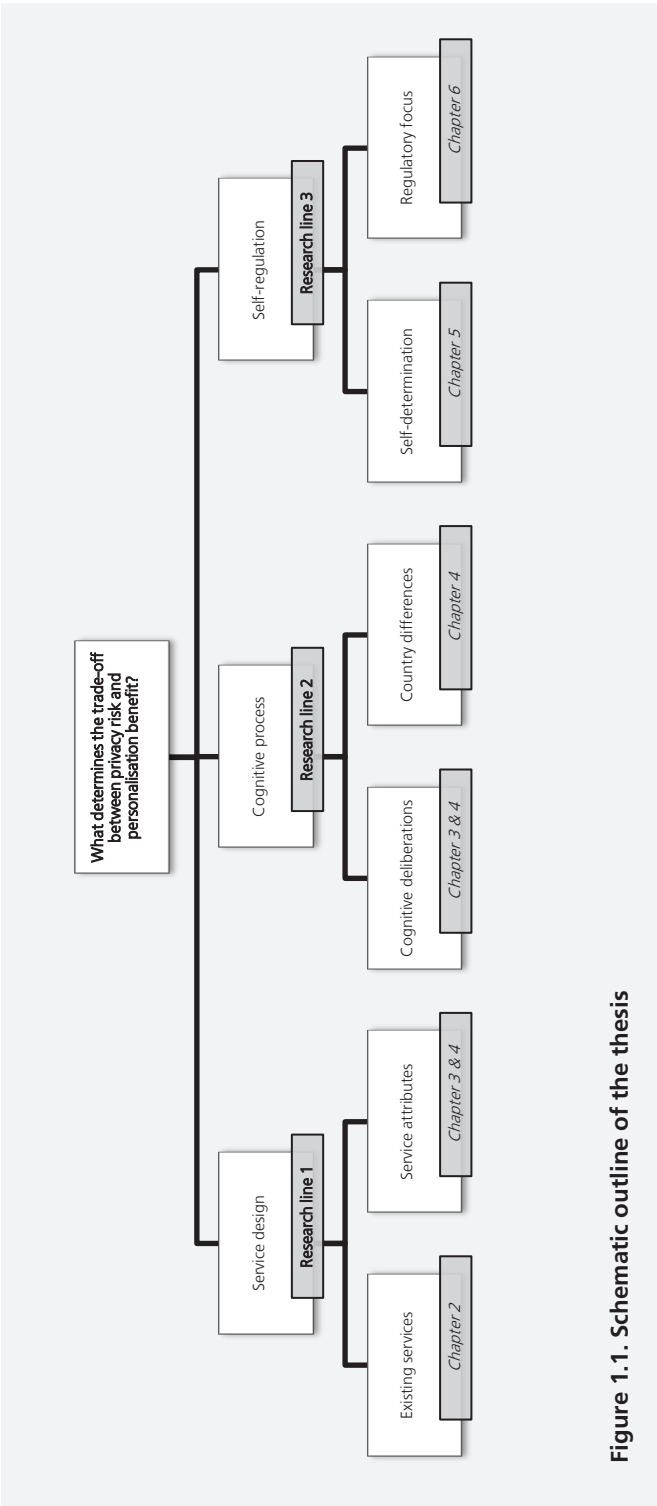


Figure 1.1. Schematic outline of the thesis

Overview of existing personalised nutrition services

This chapter is an adapted version of:

*Ronteltap, A., van Trijp, H. C. M., Berezowska, A., & Goossens, J.
Nutrigenomics-based personalised nutritional advice. In search of a business model?
Genes and Nutrition, 8(2), 153-163, (2013)
doi: 10.1007/s12263-012-0308-4*

Abstract

Objective: Nutritional advice has mainly focused on population level recommendations. Recent developments in nutrition, communication, and marketing sciences have enabled potential deviations from this dominant business model directed towards the personalisation of nutrition advice. Such personalisation efforts can take on many forms, but these have in common that they can only be effective if they are supported by a viable business model. This study provides an overview of possible personalised nutrition business models.

Method: An inventory of approaches to personalised nutrition currently available in the market place is taken as a starting point to arrive at an identification of their underlying business models. This analysis is presented as a unifying framework against which the potential of nutrigenomics-based personalised advice can be assessed.

Results: This study has uncovered nine archetypical approaches to personalised nutrition advice in terms of their dominant underlying business models. Differentiating features among such business models are the type of information that is used as a basis for personalisation, the definition of the target group, the communication channels that are being adopted, and the partnerships that are built as part of the business model.

Conclusion: There is a diversity of “archetypical” business models for personalised nutrition advice. Future research should explore consumer response to these business models as a source of market information on which the delivery of nutrigenomics-based personalised nutrition advice may further build.

2.1. Introduction

Recent developments in nutrigenomics hold the potential to revolutionise our understanding of the complex nutrition-health relationships (C. Williams et al., 2008) and as an ultimate consequence to provide a solid basis for nutritional advice tailored to the individual rather than aggregate nutritional needs (Ghosh, 2010). After all, once the complex relationships between genetic structure and effects of nutrient intake have been elucidated at a sufficiently detailed level, there should be a point where sheer knowledge of genetic composition could serve as a basis for tailored recommendations regarding nutrient intake. To put it short: “tell me who you are, and I can tell you what is good/bad for you personally”.

Nutrigenomics-based personalised nutrition advice would fit in a dominant trend in the market place, where customer-supplier relationships increasingly move from a commodity model towards a personalised model (Sutton, 2007). This is evident in various economic sectors, where marketing focus is moving from a “one size fits all” model to a model where heterogeneity in idiosyncratic customer preferences is taken into account. Also, in the context of personalised nutritional advice, several studies have suggested that tailoring nutrition advice may be more efficient in guiding people’s dietary behaviour than mainstream advice (Brug, Campbell, & van Assema, 1999; Brug et al., 2003; Elder, Ayala, Slymen, Arredondo, & Campbell, 2009; Lustria et al., 2009; Oenema, Brug, & Lechner, 2001). Such personalisation can take on many forms, including preferred communication channels, socio-demographic differentiation on for instance income, life stage, or household composition, or phenotype differentiation on for instance weight, cholesterol level, or other indicators of health status. In addition to these socio-demographic and basic phenotypic measures, early attempts have been made to also exploit nutrigenomics and nutrigenetics types of measures as a basis for personalised nutrition advice.

In general terms, personalised nutrition advice can be described as a process with consecutive stages (Vesanen & Raulas, 2006). As the first of four stages, the consumer is willing to disclose personal information that is sufficiently diagnostic to another party. Second, the other party can use this diagnostic information as a basis for developing personalised (rather than generic) nutritional advice. Third, the consumer is willing to incorporate that personalised nutrition advice as a basis for (future) food choices. Finally, if the consumer believes that the personalised advice is sufficiently rewarding over and above the generic nutritional advice, a learning process can be initiated in which a certain level of system lock-in is likely to occur. In these stages of interaction between consumers and suppliers, personalised nutrition advice can add benefits to the value exchange (van Trijp & Ronteltap, 2007). For consumers, provided that the information is simple and trustworthy, personalised advice can reduce both confusion and the costs of sifting through large amounts of nutrition information. Also, consumers may derive value from co-designing the product or service (Piller & Müller, 2004) by successfully fulfilling the co-design task

(Dellaert & Stremersch, 2005; Franke & Piller, 2004), or experiencing symbolic benefits from the process of co-design, such as pride of authorship, sheer enjoyment, and a sense of creativity in task accomplishment (Piller, 2005). Similarly for the commercial sectors, personalised nutrition advice may provide a way out of the commodity type competition, to generate added value (Ghosh, 2009).

Commercially, however, the shift towards personalised nutrition advice is a major shift away from the dominant business model that applies a population-based approach. So far, despite the potential of personalised nutritional advice, applications in the field of nutrigenomics-based nutritional advice have met with little commercial success (Saukko et al., 2010). This is probably best exemplified through the destiny of an early entrant into the market of nutrigenomics-based nutrition advice, Sciona, that has failed to find a viable business model for nutrigenomics-based nutritional advice to commercially survive.

For personalised nutrition advice to develop to its full potential, successful commercialisation to consumers is essential (Ronteltap & van Trijp, 2007). Taking a business model approach may shed light on the potential routes to success for personalised nutrition advice. A recent review on the academic use of business models found that the business model is emerging as a new unit of analysis, which bridges traditional units of analysis, such as the firm or the network (Zott, Amit, & Massa, 2011). A business model “describes the rationale of how an organisation creates, delivers, and captures value” (economic, social, or other forms of value) (Osterwalder & Pigneur, 2010). A company’s business model reflects what its management expects that customers want, how they want it, and how the company should be organised to best meet those needs while maintaining profitability.

A business model can be described through nine basic building blocks that show the logic of “how a company intends to make money”. These nine blocks cover the four main areas of a business: customers, offer, infrastructure, and financial viability. The blocks are 1) customer segments – defines the different groups of people or organisations an enterprise aims to reach and serve; 2) value propositions – the organisation seeks to solve customer problems and satisfy customer needs with value propositions; 3) channels – value propositions are delivered to customers through communication, distribution, and sales channels; 4) customer relationships – these are established and maintained with each customer segment; 5) revenue streams – result from value propositions successfully offered to customers; 6) key resources – are the assets required to offer and deliver the previously described elements; 7) key activities – are performed to offer and deliver the described elements; 8) key partnerships – some activities are outsourced and some resources are acquired outside the enterprise; and 9) cost structure – the business model elements result in the cost structure (Osterwalder & Pigneur, 2010). Zooming in on personalised nutrition advice, any business model in this area can be described by its goal of offering a personalised rather than a generic product, the need for gathering personal information from the consumer for that purpose, an algorithm to link the personal data to nutrition

knowledge – be it computer-based or human, and the personal delivery of the product to the consumer.

The aim of the present study is to “learn by analogy from success cases” in personalised nutrition advice, as a basis for nutrigenomics-based nutrition advice to meet up to its potential. For this we take a business model approach to elucidate the critical success and failure factors. In the remainder of this paper we will first describe the key components of business models in general, followed by the theoretical essence of personalised nutrition. We will then take an inductive approach by providing an inventory of approaches to personalised nutrition currently offered in the market place [personalised nutrition offers (PNOs)]. We will map these onto the critical business model components. In the discussion we will exploit the analysis to identify the critical success and failure factors to move nutrigenomics-based nutritional advice approaches to a next, successful, level.

2.2. Methods

The methodology for this study progresses along three steps: 1) inventory of personalised nutrition approaches, 2) categorisation of approaches in terms of underlying business model components, and 3) extraction of “archetypical” approaches of nutrigenomics based personalised nutrition approaches as a basis for recommendation.

2.2.1. Inventory of personalised nutrition approaches

An inventory of approaches to personalised nutrition currently offered in the market place, was conducted by means of an internet search through the Google search engine in July 2011. To ensure a broad scope regarding personalised approaches and organisations, the minimal requirements for inclusion in the dataset were that the cases 1) were in the field of nutrition, 2) applied some form of personalisation, 3) offered some type of product or service, and 4) used some type of information from consumers to tailor their product or service. This is in line with our definition of the basic structure of personalised nutrition approaches. These inclusion criteria formed the ‘building blocks’ of the final search term, which was created from systematically combining terms from within the 4 building blocks (see Table 2.1).

Table 2.1. Building blocks of the final search term

Block	Search terms
1 Nutrition	Nutrition, nutritional, diet, nutri-
2 Personalisation	Personalised, personalized, customised, customized, personal, individual, tailored, tailor made, your own
3 Product	Plan, diet, advice
4 Consumer information	Nutrigenomics, genomics, metabolic balance, phenotype, genotype, genetic

The internet search process originating from this search term was iterative, starting from a general search for “personalis/zed nutrition”, which as such resulted in an overwhelming 25 million hits, and then narrowed down by systematically adding and varying terms. For example, after the term “personalis/zed nutrition”, nutrition was successively replaced by the other terms from block 1, and so on with terms from block 2, 3 and 4. For each step, the number of hits was recorded, and the cases eligible for inclusion of the first few pages were noted. The scanning of the results of one search term terminated when a sufficient level of saturation was reached, that is, when a new page did not result in any new inclusions. In addition to the English search, the terms were also entered in Dutch (the authors’ native language). This resulted in a total of 76 cases¹ that could be considered key examples of personalised nutrition. These cases were explored in more detail, and described in terms of their key features: company size, country of operation, type of information gathered from consumers, target consumer group, and type of personalised offer.

2.2.2. Categorisation

The initial selection of 76 cases formed the basis for an interactive session among the authors in August 2011. The aim of this task was to identify sources of similarity and difference between the identified examples, in terms of their underlying structure and business model. For this purpose, the business model canvas (Osterwalder & Pigneur, 2010) was taken as a structuring tool. Starting from the key value proposition, central to any business model, the examples were further categorised on the basis of other elements of

¹ During an author discussion session, 3 more organisations were manually added, namely the Nutrition Centre (the Netherlands), the Healthy Eating Club (Australia), and Weight Watchers (international). The first two were added as they represent a category of personalised nutrition business models with government funding, the third was added as it is one of the largest and most widely known organisations in the field of personal nutrition advice.

the business model, starting from key activities, key resources, channels, and customer segments, and later further refined for customer relationships, revenue streams, key partnerships and cost structure.

2.2.3. Archetypical approaches to personalised nutrition

Rather than seeking for completeness, this task aimed to search for diversity to extract a smaller number of personalised nutrition “archetypes” that currently exist in the market place and could serve as a relevant business context and a source of inspiration for the identification of nutrigenomics-based personalised nutrition business model. After careful discussion, a more limited number of such archetypes was extracted, based on dominant business models that seem to underlie them.

2

2.3. Results

2.3.1. Inventory of personalised nutrition approaches

The internet search resulted in 76 cases from the following countries: New Zealand, USA, France, Germany, the Netherlands, Australia, Belgium, South Africa, Spain, Canada, Ireland, India and United Kingdom.

2.3.2. Categorisation of personalised nutrition approaches

Tables 2.2 and 2.3 show some basic characteristics of the sampled cases, purely for descriptive purposes². Personalisation on the basis of dietary intake data, refined for baseline background variables such as age, gender and BMI, is the dominant approach within the market place. A substantial share of cases, has adopted relevant phenotypic information (e.g. blood pressure, body fat, waist-to-hip-ratio, cholesterol) as an additional source of meaningful differentiation in personalised nutrition advice. The inclusion of genotypic information is still an exception, rather than a main stream activity in the market of personalised nutrition advice. In terms of targeted market segments (results not shown), the focus within the cases in our dataset is at people wanting to lose weight (at least one of the target groups in 46 cases) or people who want a healthier lifestyle (at least one of

² Note that because of the informal sampling procedure, the dataset does not permit for any meaningful statistical analysis, as its aim is to represent relevant diversity rather than completeness and representativeness.

the target groups in 35 cases). Less frequently, observed target groups are diseased or allergic people.

There is a large variety in additional products or services available from the company that offers a personalised service (e.g. recipes, books, journals, courses, iPhone apps, online communities, and online shops). These are not just communication channels, but in many cases also crucial elements of the earning model in terms of revenue streams and customer relationship management (retention). As to the costs related to PNOs, the majority of PNOs in the dataset falls within the price range of 0-100 Euros (n=54); 15 PNOs cost >100 Euros. In the case of follow-up activities (e.g. feedback changes in health status), expenses are higher than in the case of one-off visits. Also, cases that use consumers' genetic information are more expensive than others.

Table 2.2. Types of personal information

		Number of cases
1	Dietary intake data (including age, gender, and BMI)	40
2	Dietary intake data + phenotypic information	27
3	Dietary intake data + phenotypic information + genotypic information	9

Table 2.3. Types of personalised offers

		Number of cases ¹
1	Personal diet plan/advice	64
2	Personal coach	24
3	Personalised shopping list	6
4	Personal lifestyle advice	17
5	Other	11

¹ Cases may offer multiple types of products/services. Therefore, the number of cases add up to more than 76

2.3.3. Personalised nutrition business model archetypes

Business models represent complex and interrelated / contingent decisions on a number of key elements in relation to the market approach strategy. As such business models can appear in a wide variety of different forms, both in business-to-business (B2B) and business-to-consumer (B2C) contexts. Qualitatively, we have extracted nine dominant business models that seem to have gained a foothold in the market place. These nine “archetypes” are mapped onto the nine components of the Osterwalder and Pigneur (2010) business model canvas (see Table 2.4), and will be described briefly in the following:

1. *“Employee lifestyle guidance”*

This is a business model in the B2B context, offering lifestyle advice programmes to employees. Its key value proposition focuses on a shared responsibility of employees and employer for a healthy lifestyle relevant to employee wellbeing and productivity. The key activity is feedback to employees on lifestyle plans that are based on individual information and diagnostic data. Customer relationships are established by a one-to-one partnership with the client to build employee satisfaction and performance.

2. *“Standing strong together”*

The key value proposition of this archetype is to enhance healthy lifestyle improvement through social support rather than individual struggle. Social support and even a certain level of peer pressure are adopted to increase self-control and compliance to health advice. Key activities are the organisation of social reinforcement networks for improving health (most often weight loss), and the production and distribution of health foods (most often slimming products).

3. *“Health club”*

The key value proposition in this model is similar to that of “standing strong together” but with a more balanced focus between own responsibility and institutional support, with a lower level of peer pressure and social support. It is typically based on a broader range of lifestyle changes required for weight management, appearance, or fitness. Key activities are the maintenance of training facilities, coaching in physical training programmes including dietary intake advice, product sales (e.g. supplements, training gear).

4. *“Do-it-yourself-healthy-diets”*

The value proposition in this archetypical model is of a more distant nature, often internet-based. The model provides a diagnostic tool based on individual dietary intake data coupled to a tailored dietary advice. However, the initiative and follow-up is left entirely to the consumer. The channel used is the internet, there are little follow-up options, and the target group is people who occasionally want to improve their food choices.

Table 2.4. Matrix of PNO archetypes and business model elements

	1 (n=6)	2 (n=1)	3 (n=5)	4 (n=10)	5 (n=15)	6 (n=17)	7 (n=8)	8 (n=12)	9 (n=2)
<i>CS</i>	B2B (HRM), Medium/large corporations	People who want to change body weight	People who change body weight/ improve appearance/ become fitter	People who occasionally want to improve food choices for health	Health conscious people	Health conscious people, probably aware of health problem	People who want to improve food choices for health	People often diagnosed to require dietary guidance	General population in search for dietary advice
<i>VP</i>	Better employee performance and loyalty	Guaranteed persistent weight loss	Individual lifestyle support for weight mgmt., appearance, fitness	Facilitate healthier food choice based on personal characteristics	Stimulate improved health condition through steering healthier food choices	Stimulate improved health condition through guiding healthier food choices	Facilitate integrated choices leading to balanced lifestyle	Facilitate personal healthy food choice	General guidance for population health
<i>CH</i>	In-company sessions	Group sessions	Individual & group sessions	Internet (little follow-up options)	Internet (optional: session)	Internet	Internet	Face-to-face sessions	Internet, brochures
<i>CR</i>	1-to-1 partnership with client	Dedicated personal assistance	Dedicated personal assistance	Individual online relation	Individual online relation (optional: personal with dietitian)	Individual online relation (high frequency)	Individual online relation (high frequency)	Individual real-life relation	Non-individual (often online)
<i>RS</i>	Single B2B contract, payment on success rate	Programme subscriptions, purchased food products	Club membership, payment per session, purchased products	Subscription to online service (optional: secondary ads)	Subscription to online service (optional: individual session)	Subscription to online service (optional: individual session)	Subscription to online service (optional: individual session), sampling and testing	Patient visits (possible also house calls)	Government budget (non- profit)

KR	Customer relationship managers, trainers, database managers	Cuman (trainers), Brand	Human (trainers)	Algorithm for personalised advice based on dietary intake/ preferences	Phenotypic data interpretation, algorithm for advice	Phenotypic data interpretation, algorithm for advice	Phenotypic and genotypic data interpretation, algorithm for advice	Knowledge of dietary data analysis and impact of diet on health	Peer-reviewed scientific know-how
KA	Coaching, data collection and integration	Organising social reinforcement network, organising production of food products	Operating training facilities, individual coaching, sales of products	Gathering info on dietary intake, providing advice	Gathering info on dietary intake, self-reported parameters, providing advice	Gathering info on dietary intake, self-reported parameters, organising physiological and genotypic data sampling and testing, providing advice, monitoring progress	Gathering info on dietary intake, self-reported parameters, organising physiological and genotypic data sampling and testing, providing advice, monitoring progress	Gathering info on dietary intake and lifestyle, providing advice	Issuing general recommendations on dietary intake
KP	Diagnostic testing companies, dietitians, software companies	Food producers	-	-	Possibly dietitians	Physiological data analysis specialists, diagnostic labs	Physiological and genomic data analysis specialists, diagnostic labs	-	-
C\$	Diagnostic kits, personnel, software, marketing, sales	Facilities for group meetings, personnel, food production, marketing, sales, advertising	Facilities, fitness devices, personnel, marketing, sales	Website maintenance, personnel, marketing, sales	Website maintenance, personnel, marketing, sales	Website maintenance, data analysis, personnel, marketing, sales	Website maintenance, sampling, testing, data analysis, personnel, marketing, sales	Office and examination facilities, advertising	Website maintenance, brochure production, personnel

CS=customer segments, VP=value propositions, CH=channels, CR=customer relationships, R\$=revenue streams, KR=key resources, KA=key activities, KP=key partnerships, C\$=cost structure

5. *“Step in, step out”*

This archetypical business model takes the “do-it-yourself-healthy-diets” model one step further by including non-invasive phenotypic information in addition to dietary intake data. Key activities are gathering information on dietary intake from the individual, as well as self-reported phenotypic parameters, providing dietary advice and optional feedback based on monitored progress. The mostly used channel is the internet, but face-to-face contact or telephone sessions are also possible.

6. *“Test and run to the finish”*

This business model takes the “step-in-step-out” model one step further by providing consumers with relevant feedback on progress towards health improvement based on relevant biomarkers, both non-invasive and invasive phenotypic measures. The key feature is an iterative feedback loop that assures follow-up on consumers’ progress and the possibility to adjust the dietary advice accordingly.

7. *“All-in lifestyle guidance”*

This archetypical business model extends the “test-and-run to the finish” model in two directions. Next to dietary intake data and phenotypic information, it includes genotypic information as a base for personalised advice, and as a monitor for goal approach. Also, the personalised advice is broader in scope by in addition to dietary improvements also including lifestyle changes such as activity levels, or stress/time management. The key feature is the inclusion of genetic information as well.

8. *“Face 2 face”*

This archetypical business model is close to that of traditional dietitian’s advisory services. The value proposition is that of personal contact and face-to-face guidance through personalised advice based on dietary intake data. The key feature is the type of customer relationship building, which is an individual real-life situation. Target groups are people who are diagnosed to require some form of dietary guidance (e.g. diabetics, food allergic patients).

9. *“We told you so”*

This business model archetype represents the traditional information-based approach to improving healthy lifestyle following the “explain and prescribe” dogma. Many governmental organisations follow this approach as part of nutrition education programmes on lifestyle change for public health improvement. In terms of information channel it is based on mass media communication channels and increasingly through internet-based communication. There is some (target population advice) but only limited personalisation involved, based on dietary intake data alone and no personal contact. A key distinguishing feature is that the source of the (personalised) nutrition advice is a non-profit organisation, which may increase the model’s trustworthiness.

2.4. Discussion

Recent advances in the nutritional sciences have enabled nutritional advice to move further beyond the “one size fits all” population level recommendations for healthy eating and healthy lifestyle. Such development fits well within a broader societal trend of personalising market offers to the specific needs and wants of identified segments of consumers. Examples are abundant ranging from rather informal personalised advice obtained from Amazon.com (“consumers who bought this book, also purchased”) to very intimate one-to-one exchanges with therapists on the basis of thorough diagnosis and continuous counselling. Such personalised advice, whether nutritional or otherwise, critically depends on a number of interactions between the consumer and the provider of the advice. They all have in common that they work from identified information from the consumer (which can be released in different ways), and involve a defined communication channel to transfer that diagnostic information to the provider (which can be verbal reports or biological measures, transferred through distant and impersonal channels such as the internet and/or personal exchanges as with one-to-one meetings with the dietitian). Once the information is received by the provider it needs to be translated into a tailored advice, which is communicated back the consumer again through some sort of communication channel. Upon receiving that personalised advice, it is to the consumer to live up to the advice. Important to goal achievement in the case of healthy lifestyle is that this is a continuous rather than a one-off relationship as in many other personalised advice systems.

Not only the public health but also the commercial success of personalised nutrition advice depends on enduring relationships with the consumer, which come at a positive revenue vs. cost structure. This is essential to a viable business model underlying the personalised nutrition advice. The present study has uncovered archetypical approaches to personalised nutrition advice in terms of their dominant underlying business models. The inventory of personalised nutrition advice approaches currently existing in the market place has identified a number of differentiating features among such business models for which the business model canvas has shown particular diagnostic value.

A first differentiating feature is the type of information that is used as a basis for personalisation. This information can be relatively “innocent” (e.g. current dietary patterns) and become increasingly more invasive or personal (e.g. different types of phenotypic information), to even include very “sticky” (von Hippel, 1994) and personal information such as genetic constitution. Clearly, the diagnostic value increases with the level of stickiness, but with that may come a higher degree of reluctance on the part of the consumer to share that information, because of privacy reasons and the effort of making it available. Future research needs to focus more in depth on the trade-offs between these two dimensions of making genetic information available as a basis for personalised nutrition advice.

Despite the long-recognised potential of nutrigenomics, the results show that the use of genotypic information as a basis for personalised nutrition advice is still an exception. Our data do not allow us to analyse the underlying causes at the consumer, market and business level, but this clearly constitutes a promising area for future research. For example, this reluctance may be due to lack of consensus on the scientific substantiation of genotype markers, and/or specific consumer concerns regarding genotype applications (e.g. price, time to do the test, fear of genetics etc.). Early work in this area (e.g. Stewart-Knox et al., 2009) suggests that such consumer attitudes towards genetic testing and personalised nutrition may be quite heterogeneous, not just varying by age and country, but even by the type of health issues being addressed. This directly relates to the definition of the target group as another dimension of the business model. Whereas the reluctance to make detailed and personal information such as genetic information available for curative purposes may be lower, a major public health contribution of a wider, and more relevant, application of nutrigenomics-based nutrition advice would come from preventative purposes. Future research would need to focus on how also at the preventive level nutrigenomics-based personalised nutrition advice could get a stronger foothold in the market place. A specific point of attention would be whether this application would be restricted to dietary advice or could apply to a broader repertoire of behaviours as part of a healthy lifestyle (e.g. sufficient physical activity, or preventive self-screening methods). Crucial to any successful business model is consumer retention, as it is much more cost-efficient to retain customers than to find new ones. Although it would be relatively easy to persuade consumers into a single contact, the true value both in public health and commercial terms comes from consumer retention. This needs to be managed to establish a certain level of “consumer lock-in” to the system. This in itself is closely related to the communication channels that are being adopted. Internet based application are widespread due to their low cost application and high degree of freedom on the part of the consumer, but they carry the risk of low retention. Future research should focus on ways in which nutrigenomics-based nutrition advice can carry such degree of lock-in to move it beyond a one-off interaction. This would need to be achieved by clear follow-up activities beyond the first diagnosis, to include a rewarding feedback on progress beyond the intended health goal.

Finally, central to any business model is the financial component. As basing nutrition advice on sticky and personal information such as genomics comes at a price (adequate diagnosis), business models for nutrigenomics-based nutrition advice need to be explicit about the turnover they generate. Good examples are available in terms of complementary cash-generating activities, such as the products that the Weight Watcher’s business model offer as an integral part of the business model. Because genetic information is very sensitive, trust in how this information is being handled is crucial. This is where partnerships as a dimension of business models come in. Crucial to any successful business model for nutrigenomics-based nutrition advice is that the translation step between genomics information and the nutritional advice is transparent and beyond any doubt. Future

research might further explore the most trustworthy sources, also as a basis for partnerships to commercial partners, to support this crucial step in the process.

2.4.1. Limitations

As a first effort to identify underlying business models for personalised nutrition advice, the present study is not without its limitations. First, the present study took a broad inventory to personalised nutrition offerings as they currently exist in the market place through an internet based search. Although we took great care to include relevant cases, by definition the outcome is determined by the efficacy of the search terms. Clearly, the fact that we added three cases manually simply because these well known cases were not retrieved from the internet as examples of personalised nutrition is illustrative to this point. It cannot be ruled out that we have missed other relevant cases in this qualitative approach. Also, it is indicative that we have not been able to pick up relevant cases of nutrigenomics-based nutrition advice from the internet search. This shows that this is not a dominant model in the present state-of-the-art.

Second, the reduction of retrieved cases to a limited number of nine archetypical approaches is by definition a subjective exercise. Although we took great care and were effective in capturing the cases retrieved from the internet, it cannot be ruled out that we missed other relevant business models.

Nevertheless, we feel that the present effort to link personalised nutrition advice cases to their underlying business models has been a worthwhile exercise to understand the business context in which nutrigenomics-based nutrition advice operates. It is clear from our analysis that this field is still in its infancy, perhaps not so much on its scientific development, but specifically on its potential to become a viable business proposition. Consumer acceptance and particularly consumer retention are crucial to the success of this development (Ronteltap, van Trijp, & Renes, 2009; Ronteltap, van Trijp, Renes, & Frewer, 2007), and primarily in relation to careful segmentation, targeting and positioning through offers attractive to the consumer. Future research might specifically explore further the consumer responses to the diversity of "archetypical" business models for personalised nutrition advice as a source of market information on which the delivery of nutrigenomics based personalised nutrition advice may further build.

Consumer evaluations of personalised nutrition service attributes

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Understanding consumer evaluations of personalised nutrition services in terms of the privacy calculus: a qualitative study
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Abstract

Objective: Personalised nutrition may provide major health benefits to consumers. A potential barrier to the uptake of personalised nutrition is consumers' reluctance to disclose sensitive information upon which personalised nutrition is based. This study adopts the privacy calculus to explore how personalised nutrition service attributes contribute to consumers' privacy risk and personalisation benefit perceptions.

Methods: 16 focus groups (N=124) were held in 8 EU countries, and discussed 9 personalised nutrition services that differed in terms of personal information, communication channel, service provider, advice justification, scope, frequency, and customer lock-in. Transcripts were content analysed.

Results: The personal information that underpinned the personalised nutrition advice contributed to both privacy risk perception and personalisation benefit perception. Disclosing information face-to-face mitigated the perception of privacy risk and amplified the perception of personalisation benefit. Personalised nutrition advice provided by a qualified expert and justified by scientific evidence increased participants' value perception. Enhancing convenience, offering regular face-to face support, and employing customer lock-in strategies were perceived as beneficial.

Conclusion: This study suggests that to encourage consumer adoption, personalised nutrition services have to account for face-to-face communication, expert advice providers, support, a lifestyle-change focus, and customised offers. The results provide an initial insight into service attributes that influence consumer adoption of personalised nutrition advice.

3.1. Introduction

As nutritional needs are known to differ within a population (Bouchard & Ordovas, 2012; German et al., 2011), nutritional intake recommendations differentiate for population segments such as children, adults, pregnant women and diabetics (de Roos, 2013; Joost et al., 2007). Technological advances in the fields of genomics, transcriptomics, proteomics and metabolomics (Fenech et al., 2011; J. Little & Hawken, 2010) make it possible to further specify nutritional intake recommendations by tailoring them to individuals rather than sub-groups of a population. A detailed overview of the technological advances and their applications is provided by García-Cañas et al. (2010).

The individual approach to dietary intake recommendations, called personalised nutrition, is often associated with nutritional genomics (Astley & Elliott, 2007; Kussmann & Fay, 2008; Mutch, Wahli, & Williamson, 2005). Comprising both nutrigenomics (i.e. the effect of nutrients on gene expression) and nutrigenetics (i.e. the effect of genes on the response to nutrients), nutritional genomics studies the relationship between the genome, nutrition, and health (Farhud et al., 2010). Personalised nutrition is, however, not limited to the application of DNA (Gibney & Walsh, 2013). It can also be based on phenotypic information such as blood chemistry, weight and height, or lifestyle information such as dietary intake (Boland, 2008; Rimbach & Minihaane, 2009).

Individually tailored dietary recommendations may be associated with major health benefits. Compared to advice aimed at population segments, tailoring dietary recommendations to the individual not only generates more appropriate recommendations, but also increases the perceived (added) value of the recommendations in the eyes of the consumer (Simonson, 2005). In turn, such increased value perception is likely to contribute to higher levels of involvement in, satisfaction with and loyalty to personalised dietary recommendations (Fan & Poole, 2006; Sunikka & Bragge, 2008; Wu, 2011). The current drive for preventive personalised nutrition applications comes from commercial enterprises, which are not necessarily supported by regular health care services (Goddard et al., 2009; Ronteltap, van Trijp, Berezowska, & Goossens, 2013). This implies that the adoption of personalised nutrition largely depends on direct-to-consumer advertising rather than medical prescription. Regardless of the ethical desirability of direct-to-consumer personalised nutrition applications and the need to regulate this development (Ahlgren et al., 2013), at this stage it is reasonable to expect that the potential benefits of personalised nutrition depend on the adoption of personalised nutrition by consumers.

Central to the concept of personalised nutrition is the use of personal and potentially sensitive information about the individual to generate personalised dietary recommendations. Once personalised nutrition has reached its maturity, the specificity and with that value of the dietary recommendations will depend on the individuality and detailedness of the available information (van Trijp & Ronteltap, 2007). Receiving highly

relevant and personalised dietary recommendations (i.e. personalisation benefit) will, therefore, come at the price of disclosing very personal and potentially sensitive information (i.e. privacy risk) about the self. With DNA being the most, and lifestyle being the least, personal and sensitive form of information.

In the Information Science and Systems literature (H. Li, Sarathy, & Xu, 2010; T. Li & Unger, 2012; Heng Xu, Teo, Tan, & Agarwal, 2009), tension between information disclosure risks and information disclosure benefits is considered typical for many (personalised) services, and is often dissolved in the privacy calculus. The privacy calculus (Pavlou, 2011; Smith et al., 2011) is a trade-off between information disclosure risk and associated (personalisation) benefits, which assumes that consumers will agree to disclose sensitive information about themselves as long as they expect to benefit from it. With the emergence of online banking, shopping, and governance, the privacy calculus has gained broad attention in the Information Systems literature. Nevertheless, it has not yet been widely used in relation to health. Limited evidence, however, shows that the privacy calculus can be relevant to the health domain (Anderson & Agarwal, 2011; Oliver et al., 2012; Wendel, Dellaert, Ronteltap, & van Trijp, 2013) (Figure 3.1).

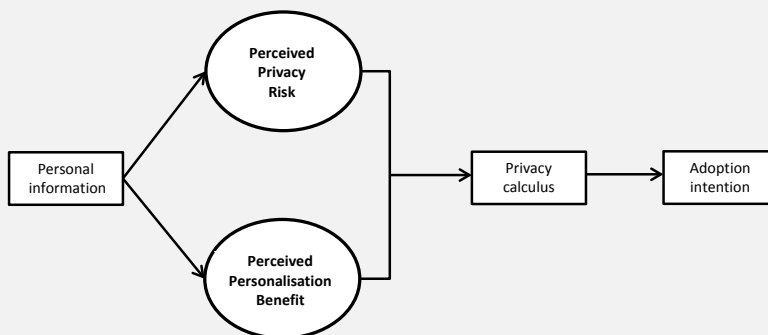


Figure 3.1. Conceptual framework

Since personalised nutrition advice cannot be generated without personal information, reducing the risk-benefit tension by fully removing the privacy risk component is impossible. Consequently, ensuring that during the privacy calculus personalisation benefits will offset privacy risks can only be achieved by mitigating privacy risk perceptions and/or amplifying personalisation benefit perceptions (Y. Li, 2012; Xie, Teo, & Wan, 2006). Hence, to consolidate the adoption of personalised nutrition an acceptable balance between privacy risks and personalisation benefits needs to be established. An opportunity to establish an acceptable balance between privacy risks and personalisation benefits is provided by the process of personalised nutrition provision. The provision of personalised nutrition is characterised by an information exchange process between a consumer and a service that generates the personalised nutrition advice (van Trijp & Ronteltap, 2007). This information exchange process involves three critical stages during which consumer perceptions of privacy risk and personalisation benefit may be mitigated and/or amplified: 1) the consumer discloses personal information to the personalised nutrition service; 2) the personalised nutrition service uses the personal information to generate the nutrition advice and initiates arrangements that stimulate consumers to adhere to the advice; 3) the personalised nutrition service provides the nutrition advice to the consumer. The three stages have been identified as essential elements of personalised nutrition business models, of which nine “archetypes” are currently present in the market place (Ronteltap et al., 2013) (Chapter 2 and Table 3.1).

To date, none of the commercial personalised nutrition services available in the market place seems to have succeeded in attracting large groups of customers (Ronteltap et al., 2013). This suggests that none of the current personalised nutrition services has managed to create a widely acceptable balance between privacy risks and personalisation benefits. Building on the nine archetypical personalised nutrition business models, this study aims to explore consumer evaluations of personalised nutrition services and clarify how these evaluations contribute to an individual's privacy calculus. Such an understanding will provide guidance for the development of personalised nutrition services that are considered worthwhile by consumers. Ultimately, an increased uptake and adoption of personalised nutrition services could improve public health and thus contribute to both economic and social wealth. As improved public health is a vital goal for all EU member states (European-Commission, 2007; Eurostat, 2011a, 2011b), data was collected in eight EU countries.

Table 3.1. Descriptions of archetypical personalised nutrition business models

	Business model	Description
1	"Employee lifestyle guidance"	An employer offering a lifestyle advice programme to employees
2	"Standing strong together"	Enhancing healthy lifestyle through social support (e.g. Weight Watchers)
3	"Health club"	A fitness club enabling lifestyle change by providing training facilities and coaching
4	"Do-it-yourself-healthy-diets"	An internet based business model, with little or no follow-up
5	"Step in, step out"	An (often) internet based business model allowing for personal contact, which provides optional follow-up on monitored progress
6	"Test and run to the finish"	An (often) internet based business model allowing for personal contact, which provides repeated follow-up on consumers' progress and the possibility to adjust the dietary advice
7	"All-in lifestyle guidance"	Enhancing healthy lifestyle through a broad DNA-based lifestyle advice
8	"Face-2-face"	Traditional dietitian's practice
9	"We told you so"	Healthy lifestyle advice offered through mass media communication channels by non-profit organisations to improve public health

3.2. Methods

3.2.1. Design and participants

Sixteen focus groups were held; two in each of the 8 European countries (Greece, Spain, the Netherlands, Ireland, UK, Germany, Poland, and Norway) that were selected for this study. All 124 participants were recruited through a market research company or the national data collection centres. Participants perceived themselves as healthy and were aged 18-65. Socio-demographics are provided in Table 3.2. Ethical approval was granted in

Table 3.2. Socio-demographic characteristics of the sample (N=124)

	Percentage of respondents
<i>Age</i>	
18-30	20.2%
30-45	39.5%
45-65	38.7%
Not recorded	1.6%
<i>Gender</i>	
Male	49.5%
Female	49.5%
Not recorded	1.0%
<i>Marital status</i>	
Married	47.6%
Lives with partner	16.1%
Divorced	4.0 %
Single	29.0%
Other	1.6%
Not recorded	1.7%
<i>Education¹</i>	
Primary	11.3%
Secondary	36.3%
Tertiary	50.0%
Not recorded	2.4%
<i>Income²</i>	
Less than modal	20.2%
Approximately modal	16.1%
Higher than modal	42.7%
Not recorded	21.0%

¹ Primary = levels 0,1 and 2; secondary = levels 3 and 4; tertiary = level 5, 6, 7 and 8 of the international standard classification of education (UNESCO Institute for Statistics, 2012)

² Compared to the national modal wage of the participant's country of origin

accordance with international standards, and written consent was obtained from all participants.

The focus groups followed an extensive semi-structured interview protocol. The protocol was developed in English and translated into Dutch. The Dutch protocol was piloted in a focus group of 7 participants. The pilot study resulted in some minor amendments that were incorporated into the English protocol. The English protocol was translated into the national languages of the participating countries.

A local moderator and observer were assigned to conduct the focus groups within each country. All moderators were trained to use the protocol during a two day workshop. The focus group discussions were audio-recorded and transcribed verbatim. Participants' individual deliberations were captured in a response booklet.

To assure translation quality, the protocol, transcripts and individual deliberations were checked by means of back-translations (Brislin, 1970), following which translations were adjusted.

3.2.2. Stimuli and materials

Nine flyers representing fictitious personalised nutrition services based on the business models identified in Chapter 2, were used to facilitate discussion. Each flyer included all service attributes that are relevant for the three information exchange process stages (see Figure 3.2). Flyers were shown to the participants in three sets of three flyers. Per flyer set, only the service attributes that related to a particular information exchange stage varied across the flyers. The service attributes that did not represent the stage explored in a flyer set remained unvaried, with minor variations to enhance the realness and credibility of the flyers. The first flyer set contained flyers that differed with regard to the service attributes "personal information" (dietary intake, phenotype, DNA) and "communication channel" (online, mail, personal contact). The second flyer set differed on the service attributes "service provider" (dietitian, company, government/employer), "advice justification" (scientific evidence, alternative medicine, success stories) and "customer lock-in" (high initial payment followed by cheap follow-up, support group meetings, free service dependent on good results). The third flyer set varied on the service attributes "advice scope" (diet plan, diet plan/exercise plan/personal food preferences, diet plan/exercise plan/shopping list/exercise facilities/lifestyle advice), "advice frequency" (one-off, once every 3 months, once a week) and "communication channel" (online, mail, personal contact). Table 3.3 provides an overview of the stimulus material.

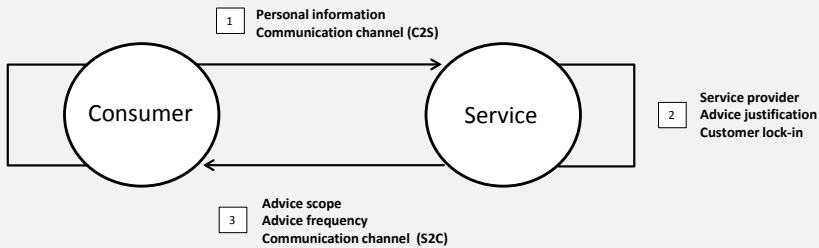


Figure 3.2. Schematic overview of the personalised nutrition information exchange process and its attributes

3.2.3. Data generation procedure

Participants were welcomed to the focus group. The moderator, observer and participants, introduced themselves. The moderator explained the ground rules (e.g. only one person speaks at a time) of the discussion.

As a warm-up, each participant wrote three words or short sentences about what personalised nutrition meant to him/her in the provided response booklet. Half way through the warm-up, the definition of personalised nutrition (i.e. healthy eating advice that is tailored to suit an individual) was presented to the participants. Participants were invited to voice their understanding of personalised nutrition. All words or phrases that were mentioned aloud were written down on a flipchart. After the warm-up, printed A5 full colour flyers were handed to the participants one set at a time. Participants ranked the flyer sets individually, and recorded the rankings and reasons for their preferred order in the response booklet. Then individual preferences were compared and discussed within the group. When relevant or new discussion points ceased to emerge, the next set of flyers was introduced. There was a 10 minute break between the second and the third flyer set. After all three flyer sets had been discussed, all nine flyers were ranked simultaneously. Each participant individually listed one flyer as "best" or "worst", two flyers as "moderately good" or "moderately bad" and three flyers as "neutral" in his/her response

Table 3.3. Overview of the stimulus material

Table 3.3. Overview of the stimulus material									
Disclosing personal information			Stage 2 Generating advice and advice adherence			Stage 3 Providing advice			
Business model	Personal information	Communication channel (C2S)	Service provider	Advice justification	Customer lock-in	Advice scope	Advice frequency	Communication channel (S2C)	
Set 1	"We told you so"	Online	Company	Scientific	€ 175	Diet plan	1x 2 months	Online	
	"All-in lifestyle guidance"	Mail	Company	Scientific	€ 195	Diet plan	1x 3 months	Online	
	"Step in, step out"	Personal contact	Company	Scientific	€ 185	Diet plan	1x 3 months	Online	
Set 2	"Face-to-face"	Personal contact	Dietitian	Scientific	First 2 consultations € 200, all following consultations € 20	Diet plan, lifestyle advice	1x per week	Personal contact	
	"Standing strong together"	Personal contact	Company	Alternative medicine & organic products	Support group meetings/ subscription	Diet plan, lifestyle advice	1x per week	Personal contact	

	"Employee lifestyle guidance"	Phenotype	Personal contact	Government/ Employer	Success stories	Free service dependent on good results	Diet plan, lifestyle advice	2x per month	Personal contact
Set 3	"Health club"	Dietary intake	Online	Dietitian	Success stories	Subscription €50 per month	Diet plan, exercise plan, shopping list, lifestyle advice, exercise facilities	1x week	Personal contact
	"Do-it-yourself-healthy-diets"	Dietary intake	Online	Dietitian	Success stories	€ 50	Diet plan, exercise plan, personal food preferences	Only once	Mail
	"Test and run to the finish"	Dietary intake	Online	Dietitian	Success stories	€ 75	Diet plan	1x 3 months	Online

booklet. This ranking method was inspired by the Q-sort methodology (C. W. Taylor, 1960). A group discussion on the best and the worst flyer followed. To close the discussion, participants were asked to describe their “ideal” personalised nutrition service. Table 3.4 provides an overview of the focus group protocol.

Each focus group consisted of 5-10 participants and lasted approximately 2.5 hours. Participants received a monetary payment equivalent to €35 as a compensation for their time.

Table 3.4. Overview of the focus group protocol

Protocol stage	Content
Introduction	Introduction of the staff and participants, clarification of discussion ground rules
Warm-up	Defining the meaning of personalised nutrition before and after definition
Round 1: Disclosing personal information	<ul style="list-style-type: none"> • Individual ranking of flyer set1 • Plenary discussion of flyer set 1 ranking
Round 2: Providing advice	<ul style="list-style-type: none"> • Individual ranking of flyer set 3 • Plenary discussion of flyer set 3 ranking
Break	
Round 3: Generating advice and advice adherence	<ul style="list-style-type: none"> • Individual ranking of flyer set 2 • Plenary discussion of flyer set 2 ranking
Round 4: Overall ranking	<ul style="list-style-type: none"> • Individual ranking of all flyers • Plenary discussion of best/worst flyer
Wind-down	Discussion on the “ideal” personalised nutrition service
Wrap-up	Final thoughts and word of thanks

3.2.4. Data analysis

First, the individual opinions written down in the response booklets were content coded using a predefined coding scheme that consisted of all service attribute levels (e.g. personal contact, dietitian, DNA) (see Table 3.3). Opinions were coded according to positive and negative attribute level evaluation. Positive codes were assigned to arguments for ranking a flyer as “best”. Negative codes were assigned to arguments for ranking a flyer as “worst”. If a participant ranked a flyer as “worst”, but clearly stated that he/she liked one of its attribute levels, the attribute level was coded as positive and vice versa. If a participant evaluated the presence of an attribute level as positive, and the absence of that same attribute level as negative, only the positive evaluation was coded.

Second, discussion transcripts were content analysed starting from the code book that was used for the analysis of the individual opinions, but allowing for the identification of new codes. Transcripts were examined for rationales underpinning positive and negative attribute level evaluations. In order to form code families, three of the authors discussed how to assign the codes to the eight service attributes that were incorporated in the flyers. To limit the impact of isolated remarks, codes had to occur in at least two different focus groups. Data saturation was reached, as the last two transcripts did not generate any new codes.

3.3. Results

Based on the total sample (N=124), a clear pattern of preferred services emerged (Table 3.5). Across all countries, the “health club” (52%) or the “face-to-face” (27%) service stood out as most preferred business models. Identifying the “health club” and the “face-to-face” services as the two most appreciated services was consistent across countries, with small deviations. For example, in the Netherlands the “employee lifestyle guidance” was among the two most popular services, while in Spain the “standing strong together” service was one of the two favourite services. Table 3.3 provides detailed information regarding the content of the different services.

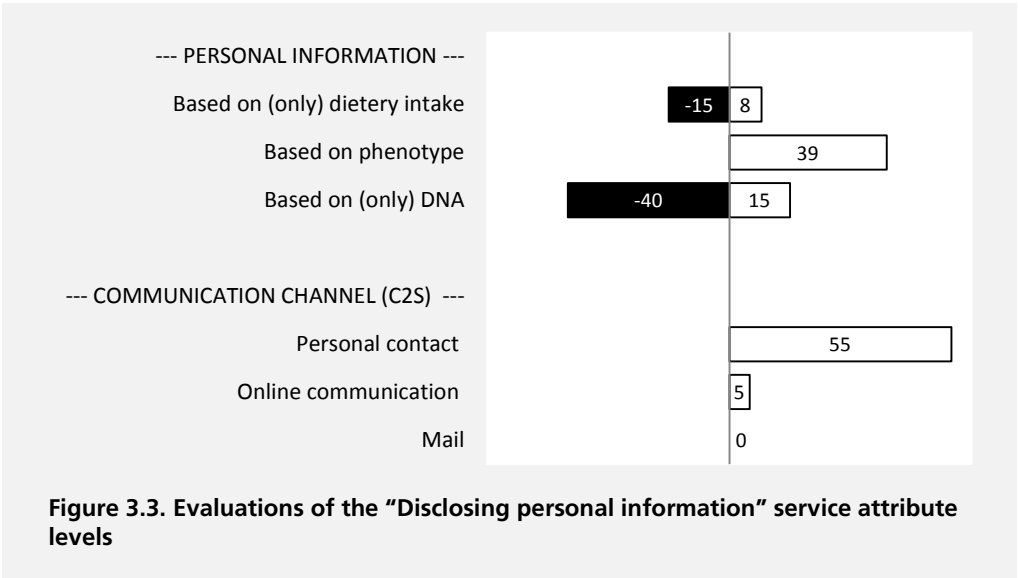
Opinions regarding the “worst” service were more diverse. Across almost all countries, however, the “all-in-lifestyle guidance” and the “employee lifestyle guidance” services stood out as the least appreciated business models. Spanish participants (81%) were particularly averse to the “employee lifestyle guidance” service. The Polish, German, and in particular the Dutch participants seemed to hold less negative attitudes towards the “employee lifestyle guidance” service. Spanish, German and Norwegian participants also seemed to hold less negative attitudes towards the DNA-based “all-in lifestyle guidance” service.

Table 3.5. Observed service preference in percentages per country																																				
Service	Total sample (n=124)				Ireland (n=20)				UK (n=17)				Netherlands (n=19)				Norway (n=11)				Spain (n=16)				Greece (n=13)				Germany (n=14)				Poland (n=14)			
	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst	Best	Worst						
"Health club "	52				55				88				63				46				20				39				43			50				
"Face-to-face "	27				25				12				5				46				38				62				36			14				
"Standing strong together"	9	11	5	10	5	10							12	11	5	5				55	31							7			14	21				
"Employee lifestyle guidance "	5	32	5	30	5	30							29	16	5	5				27				81				46	7	21	7	14				
"Step in, step out"	3	2	5		5												9							6					7	7	7					
"Do-it-yourself-healthy-diets"	3	2	5		5								12		5						6										7					
"All-in lifestyle guidance "	1	26											18		58					9	6	6					23		14			21				
"We told you so"	1	14		5		5							18	5	11												15		29			36				
"Test and run to the finish "		14		15		15							12		16					9		6					15		29			7				

Finally, the majority of the Norwegian participants (55%) chose the “standing strong together” service as the worst service, while in all other countries opinions regarding the “standing strong together” service were positive or mixed.

3.3.1. Disclosing personal information

Individual opinions about personal information show that personalised nutrition based on phenotype (e.g. blood, height, weight) generated unanimously positive opinions. Remarks regarding dietary-intake-based personalised nutrition were mixed in terms of valence. Comments concerning DNA-based personalised nutrition were primarily negative, although a few participants expressed positive associations with DNA-based personalised nutrition (Figure 3.3).



In the group discussions participants indicated that medical tests are required to make personalised nutrition truly personalised. Phenotypic information was considered a good foundation for personalised nutrition, because measures such as weight, height and blood seemed very familiar, medical and informative about health:

“But blood actually tells a lot about someone’s state of health and I think everyone is used to going to the doctor for a blood test, it does at least have a context.”

(Germany)

Even though dietary intake should be accounted for during the development of personalised nutrition advice, dietary intake alone was considered too general to establish a proper personalised diet plan. With regard to DNA, participants often did not understand how DNA could contribute to the development of personalised nutrition:

“I thought that my DNA has little to do with my food. DNA has been determined at birth. So that has little to do with healthy eating.”

(the Netherlands)

In addition to not understanding how DNA could contribute to personalised nutrition advice, taking a DNA test at home without the help of a professional was regarded as unreliable or even impossible. Furthermore, DNA was seen as very personal and privacy intrusive. Mailing DNA to an unknown company, as was the case in the “All-in lifestyle guidance” service, was unacceptable. To prevent misuse of sensitive information such as DNA, participants preferred to disclose DNA face-to-face, on location, to someone whom they trusted (i.e. hospital, doctor or dietitian):

“That you do the DNA test yourself and send it by mail and then you have no idea who receives it. I find that a bit disturbing.”

(Norway)

With regard to the communication channel individual opinions indicated that personal contact stood out to the participants as a positive and vital service attribute level. Online communication and communication through mail were hardly mentioned by participants (Figure 3.3).

Results from the group discussions pointed out that the vital role of personal contact was engendered by the belief that being able to meet the service provider would increase the trustworthiness of the service:

"I would not want to provide my personal information to anyone online who I don't know, a company I don't know... if I had to choose one it would be flyer 3 [the service where] I'm actually going to see someone."

(UK)

Furthermore, personal contact made communication easier and more flexible, since it allowed for the use of, for example, body language. In addition, personal contact encouraged participants to reveal honest and complete information about themselves. Being able to communicate with the service provider face-to-face, therefore, assured participants that their personalised nutrition advice would be based on accurate and complete information:

"I assumed when I saw "personal interview" that I would be able to add in anything that I thought was important that might not have gone on the website form."

(Ireland)

The fact that personal contact was vital and highly appreciated did not dismiss internet communication. Communicating via the internet was perceived as convenient and by no means an obstacle as long as it was supported by personal contact. However, communicating via the internet was perceived as being unfeasible to those unable to use the internet:

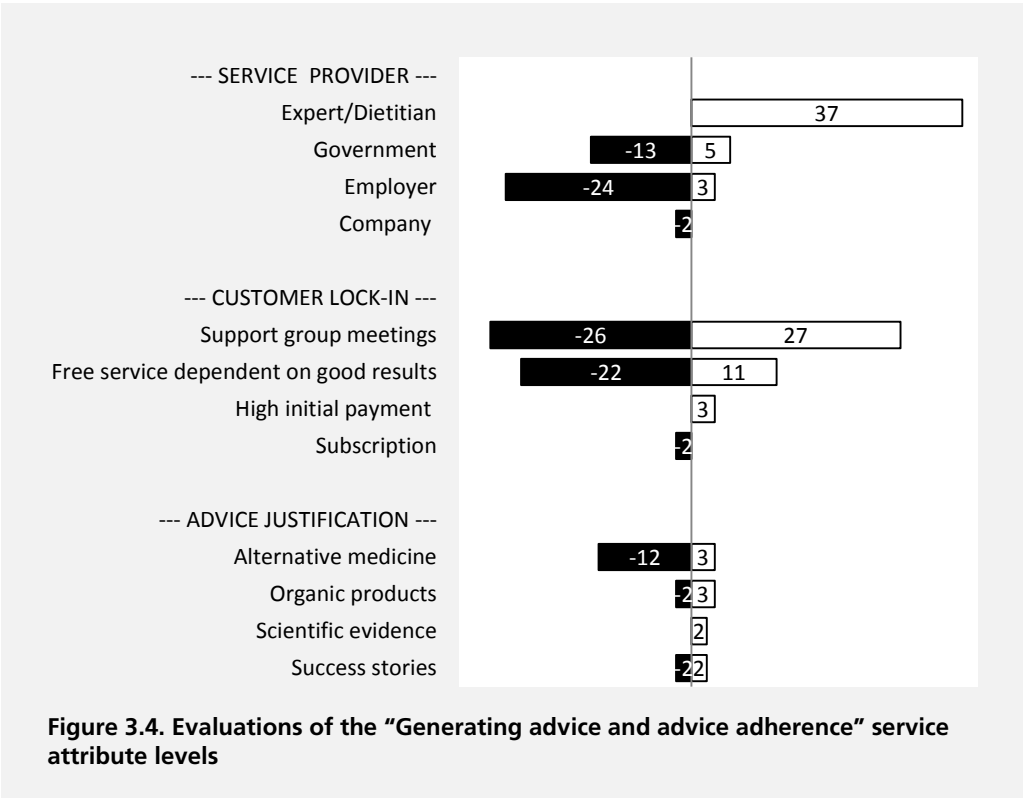
"(...) older people would struggle more with Internet, or with receiving emails or writing them, than people who are working. (...) I'm not sure if my mother could write an email."

(Germany)

In summary, participants were highly sceptical about the extent to which different types of personal information, and the way they were obtained, are suitable to generate a valuable and personalised dietary advice. Furthermore, in the case of DNA, the concern of possible information misuse emerged. Disclosing information in person increased participants' trust in the service and as a result decreased the perception of potential privacy loss.

3.3.2. Generating advice and advice adherence

The individual opinions relating to the service provider suggested that the involvement of a qualified expert (e.g. dietitian) was perceived as positive and highly appreciated. Opinions on the employer and the government as service providers were most often negative. Comments regarding an independent company as service provider were hardly made (Figure 3.4).



According to the group discussions, participants agreed that personalised nutrition should be provided by a trustworthy, qualified, expert advice provider. Factors that contributed to the trustworthiness of a provider were credentials, positive word-of-mouth, and portrait images. A physician was not always considered to be a qualified expert, because (s)he would neither have the time nor the expertise to discuss nutritional problems. Views on the government as a service provider were divided. Some participants supported the involvement of the government, because the government seemed to be trustworthy. Other participants did not favour the involvement of the government, as the government was considered to have a hidden agenda:

"It's very Big Brother is watching you."

(UK)

Also on the subject of the employer as an advice provider, opinions were divided. Participants who perceived an employer's involvement as positive argued that it was nice to see an employer care for his/her employees. Another advantage of the involvement of the employer was that it was good to have an intervention in the workplace, so that one could combine personalised nutrition with one's job and have the support of colleagues. Participants who considered the involvement of the employer as negative thought that the employer could not be trusted and stated that they did not want to be treated as a workhorse or lose their job. Another argument against the involvement of an employer was that personalised nutrition should not be forced upon employees as it has nothing to do with the workplace. Lack of privacy and the service only being available to employed individuals were the final two reasons for the dismissal of employer-driven services.

Individual opinions concerning customer lock-in reflected an almost equal division between opponents to and advocates for support group meetings as a way to generate advice adherence. Free service dependent on good results was mainly perceived as a negative lock-in, but simultaneously also accounted for positive reactions. Monthly subscription fees and high initial payment while receiving a discount on the following consultations did not receive much attention from the participants (Figure 3.4).

Group discussions show that the strong polarisation on support group meetings was caused by the individual difference of wanting to share personal matters with a group. Free service dependent on good results was regarded as a customer lock-in that could stimulate advice adherence by increasing motivation to comply:

"A plus to it was that the Human Resources department contributed to it, that could be a great motivational factor if you did not have to pay 2600 kroner."

(Norway)

Nevertheless, opponents of this lock-in argued that it had a very negative vibe. Not having to pay dependent on good results was very threatening, almost like blackmail. It was also quite risky, because at the end one might end up paying a large amount of money. Not wanting to pay for the service might even drive a person to extremes such as starvation. Not having to pay for a service dependent on good results also implied that the service provider could let someone fail on purpose just to obtain the money:

"The main objective of a company is to earn money, so if they're telling you they are going to earn money if you don't get [good] results, I think, they are going to do something in order to not make me succeed."

(Spain)

Additionally, the lack of clarity concerning what constitutes "good results" and who would define "good results" was raised as an argument against a lock-in dependent on good results. According to some participants having to pay a substantial amount of money in order to obtain personalised nutrition advice was a strong lock-in. Furthermore, having to pay for personalised nutrition advice also served as an indicator of quality:

"I always think that when something is for free it's not worth the money. Then it's something you wouldn't value a lot."

(Norway)

Participants claimed that their commitment to personalised nutrition would be highest if they would see that the advice really works.

Individual opinions with regard to the applied advice justifications did not evoke many comments. There seemed to be a tendency to dislike alternative medicine as personalised nutrition advice justification (Figure 3.4).

Group discussions revealed that alternative medicine and organic products were two service attribute levels that stood out to the participants, in both a positive and a negative way. Some participants were quite interested in, and in favour of, alternative medicine:

"Alternative medicine is interesting, I'd really like to hear something on that topic, and organic products too."

(Poland)

Participants who did not appreciate the idea of personalised nutrition advice that is justified by alternative medicine and organic products argued that such advice is more expensive, vague, unreliable, and not scientific.

The few remarks that were made about success stories pointed out that participants liked reading success stories, but that they did not regard success stories as a reliable advice justification:

"Success stories always make me suspicious you know, because you wonder do they just sit down and make up this stuff."

(Ireland)

To summarise, personalised nutrition being provided by a qualified expert increased participants' value perception of the dietary advice. Furthermore, value perception was determined by the approach that justified the advice. Stimulating advice adherence was perceived as beneficial as long as it fitted individuals' views and personalities. Being able to trust the service provider determined participants' general willingness to engage with a personalised nutrition service.

3

3.3.3. Providing advice

Individual opinions concerning advice scope indicated that providing exercise advice, in addition to dietary advice, was perceived as a positive feature of personalised nutrition services. In line with the importance of exercise, providing exercise facilities was considered a valuable addition to personalised nutrition advice. Furthermore, a shopping list and lifestyle advice were seen as valuable extensions to personalised nutrition. Accounting for personal food preferences was considered negative as well as positive (Figure 3.5).

Group discussions reflected that personalised nutrition should have a broader focus than merely weight loss. Participants agreed that personalised nutrition should aim at changing an individual's lifestyle:

"Personalised nutrition should become lifestyle, to learn how to eat right or put exercise in our life, not because we have to, for losing weight, but because... it's good for my health."

(Greece)

In line with this lifestyle focus and the fact that diet and exercise were often seen as inextricably linked, exercise was one of the most important advice extensions:

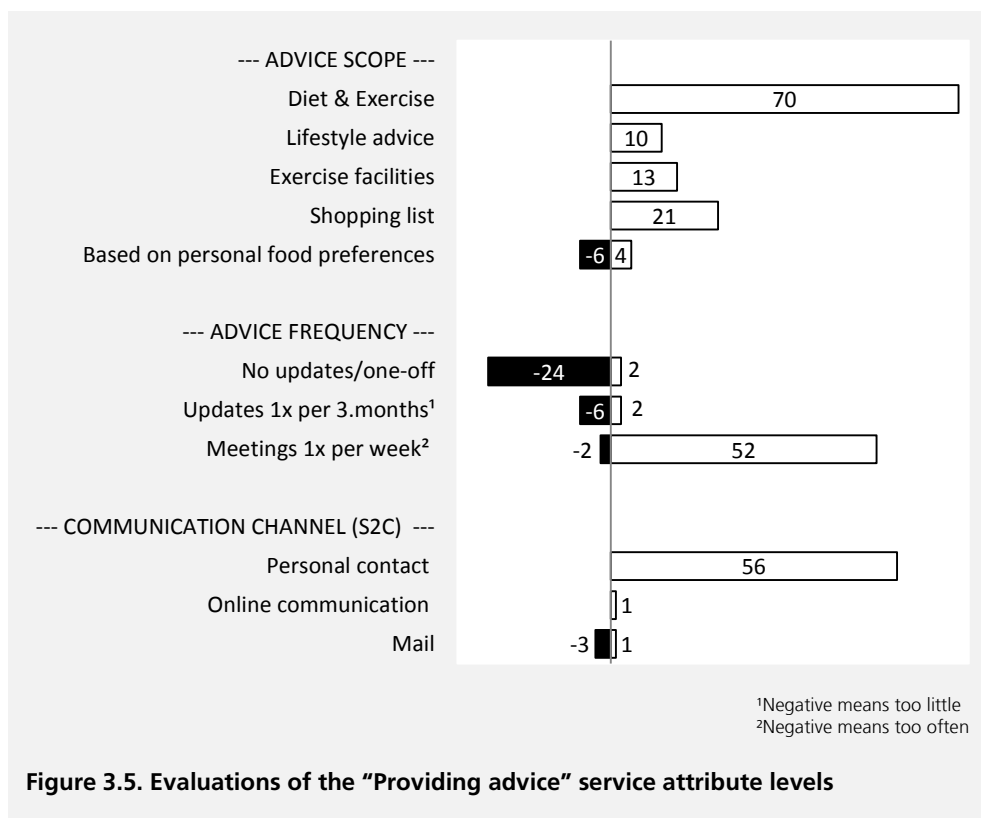
"Everyone knows that that is the best... Diet and exercise."

(the Netherlands)

In addition, advice extensions like exercise facilities and a shopping list were regarded as valuable, because they increased convenience and therefore made adhering to the advice easier. Advice adherence was also stimulated by progress monitoring and support, especially when these were provided face-to-face:

“When someone is monitoring you, then you follow the diet, because you get embarrassed the next time you go to a meeting and say you did not lose a gram.”

(Greece)



Moreover, some participants perceived accounting for personal food preferences as an attribute that contributed to advice adherence. Yet, other participants stated that personal food preferences did not belong in a proper/healthy diet because they often are unhealthy:

"The [personal food] preferences were the very reason that you now need to diet."

(the Netherlands)

Addressing psychological issues and teaching individuals how to eat healthily, were two attributes that came up without being mentioned in any of the service flyers.

Individual opinions relating to advice frequency indicated that most participants appreciated weekly meetings. However, a few participants considered weekly meetings to be too often. A one-off advice was regarded quite negatively. Receiving updated advice once every three months did not generate many comments, although the participants who did comment on this advice frequency level perceived it as insufficient (Figure 3.5).

Group discussions offered more insight into participants' underlying reasoning by revealing that regular meetings to monitor progress and provide support were considered important, as they generated motivation for advice adherence. The meaning of "regular" varied strongly between participants. For some, regular meetings were weekly, while for others, regular meetings came down to once or twice a month. According to the participants, at the beginning of the lifestyle-change-process, frequent meetings were essential for compliance. Once one is accustomed to the new lifestyle, meeting frequency could be phased out:

"In the beginning you might have the need for close follow-up and then, when you start to gain more control, then you don't need it that often."

(Norway)

Regardless of the advice frequency, follow-up should always be based on an individual's progress:

"Unless you are providing somebody with information of how you're changing and how you're sticking to your diet a follow-up diet is useless."

(Ireland)

One-off advice was considered insufficient, not only because it did not provide motivation or advice updates, but also because services that offered one-off advice seemed untrustworthy:

"With flyer 5 [once off advice] it does seem like it's, we're going to take your money and run. (...) It just seems like a £50 payment to have one diet plan and we'll never speak to you again, what's the point. You know, you need to change, it needs to change with you. Yeah that just seems really dodgy."

(UK)

Furthermore, the perception of service trustworthiness was decreased by having to pay one single payment in advance:

"To begin we only have to pay this three hundred fifty zloty once, (...) and then we don't know what comes next. If we have some questions, doubts, will they send us answers?"

(Poland)

In line with the results that were found for the disclosure of personal information, personal contact was again the most appreciated communication channel. Both the individual opinions and the group discussions mirrored the previously discussed results concerning the disclosure of personal information (Figure 3.5).

In summary, personalised nutrition extending beyond pure dietary advice was perceived to be beneficial, as the added extras often increased convenience and stimulated advice adherence. Advice adherence was also stimulated by regular face-to-face meetings. Furthermore, participants used meeting frequency to assess the trustworthiness of a service. Paying in advance for one-off services was regarded as particularly risky.

3.4. Discussion

Using structured focus group discussions in 8 EU member states, this study explored consumer evaluations of different personalised nutrition services. Personalised nutrition requires consumers to disclose personal and potentially sensitive information about themselves. This study used the privacy calculus (i.e. the trade-off between privacy risk and personalisation benefit) as its underlying framework, and linked it to the three stages of the personalised nutrition information exchange process: 1) the consumer discloses personal information to the personalised nutrition service; 2) the personalised nutrition service uses the personal information to generate the nutrition advice and initiates arrangements that stimulate consumers to adhere to the advice; 3) the personalised nutrition service provides the nutrition advice to the consumer. Service attributes of all three stages (see Figure 3.2) were expected to influence consumer adoption of personalised nutrition through the perception of privacy risk and/or the perception of personalisation benefit.

The results suggest that, in contrast to disclosing phenotypic or dietary intake information, most participants were rather negative about disclosing DNA to a personalised nutrition service. The reluctance to disclose DNA was in part triggered by consumer scepticism about how DNA can be of benefit to the generation of personalised nutrition advice. This finding confirms that the perception of personalisation benefit does indeed play a central role in the disclosure of personal information (Stage 1 of the personalised nutrition information exchange process). Consumers being sceptical about how DNA can be of benefit to the generation of personalised nutrition advice is in line with recent research (Adamkova, Veleminsky, Zimmelova, & Hubacek, 2009; Pavlidis et al., 2012; Sanderson et al., 2012), which states that consumers are often not familiar with the link between DNA and nutrition advice. Ignorance about the fact that DNA is beneficial to the generation of personalised nutrition might have lowered the perception of personalisation benefit. In addition to perceiving DNA as not beneficial to personalised nutrition, and consistent with studies into consumer attitudes (Bloss et al., 2010; Goldsmith, Jackson, O'Connor, & Skirton, 2012; Heeney, Hawkins, de Vries, Boddington, & Kaye, 2011), disclosing DNA to a personalised nutrition service was identified as a factor that increases privacy risk. Participants, for example, mentioned that DNA should not fall into the wrong hands, either when disclosing it to the personalised nutrition service, nor when it is already made available to the personalised nutrition service for the purpose of personalised nutrition advice generation (Stages 1 and 2 of the personalised nutrition information exchange process). Worrying about to whom one is disclosing DNA and how this person may use the DNA for purposes beyond the generation of personalised nutrition advice may have increased participants' privacy risk perception. Concerns regarding privacy risks were not prominent when utilising dietary intake and phenotypic information. Given that DNA-based personalised nutrition failed to provide clear personalisation benefits and simultaneously accounted for a high awareness of potential privacy risk, it is not surprising that DNA was often seen as the least favourite foundation of personalised nutrition advice. Nevertheless, we should be cautious about fully dismissing DNA-based personalised nutrition as not all consumers hold a negative attitude towards genetic testing (Nielsen & El-Sohemy, 2012). This may be especially true of individuals with an above average risk of developing chronic diseases, as they are more prepared to undergo genetic testing for the purpose of personalised nutrition (Stewart-Knox et al., 2009).

Consumer perception of privacy risk and personalisation benefit did not merely depend on the required personal information. A substantial part of the trade-off between privacy risk and personalisation benefit could be explained by other attributes of the personalised nutrition information exchange process. Especially the presence of face-to-face communication was important in determining the extent to which personalisation benefit and privacy risk were perceived. Being able to disclose personal information (Stage 1 of the personalised nutrition information exchange process) during a face-to-face meeting was perceived vital for the quality of the personalised nutrition advice, and as a consequence the perception of personalisation benefit. According to the participants, disclosing

information face-to-face resulted in more accurate and detailed information, which is necessary for truly personal dietary advice. Furthermore, disclosing personal information and/or receiving personalised nutrition advice (Stages 1 and 3 of the personalised nutrition information exchange process) during a face-to-face meeting induced the feeling of interacting with a “real” person with whom one is “acquainted”. Experiencing such feeling may have given participants a greater sense of control over the way in which a personalised nutrition service will operate. Perceiving oneself as being able to control the activities of a service determines the extent to which consumers trust that service provision will proceed as agreed (Tan & Thoen, 2001), and as a consequence will not result in negative side-effects related to privacy risk or personalisation benefit. Therefore, perceived control and trust induced by face-to-face communication may have contributed to a decreased perception of privacy risk (Belanger & Carter, 2008; Green & Pearson, 2011; D. J. Kim, Ferrin, & Rao, 2008) and an increased perception of personalisation benefit.

Face-to-face communication did, however, fail to decrease privacy risk perceptions and increase personalisation benefit perceptions when participants perceived the service provider as untrustworthy. Service providers that appeared to be driven by financial gain or who might benefit from information misuse, as was often the case with the employer and the government, were generally perceived as untrustworthy. Participants gave the impression that perceptions of privacy risk would be lower and perceptions of personalisation benefit would be higher when the personalised nutrition advice was generated by scientifically trained experts related to a dietitian’s practice or a fitness club (Stage 2 of the personalised nutrition information exchange process). Placing trust in experts who are focused on health improvement through scientific methods rather than financial gain or information misuse, relates to the three drivers of service trustworthiness identified in literature, namely: ability, integrity and benevolence (Mayer, Davis, & Schoorman, 1995). The ability, integrity, and benevolence of a service provider determine the quality of the personalised nutrition advice and the absence of negative privacy-related consequences (Colquitt, Scott, & LePine, 2007). Hence, perceiving the service provider as being able, having integrity, and being benevolent might have mitigated privacy risk perception and amplified personalisation benefit perception. The preference for scientifically trained experts related to a tangible service might also be explained by the fact that when it comes to health western consumers are accustomed to face-to-face communication (H. K. Andreassen et al., 2007) with qualified professionals trained in conventional medicine (Nissen, Schunder-Tatzber, Weidenhammer, & Johannessen, 2012). Often, consumers tend to choose services to which they are accustomed, because such services strengthen their trust in the fact that service provision will proceed as expected (Gefen, Karahanna, & Straub, 2003). Accordingly, having confidence in the success of service provision may decrease privacy risk perception and increase personalisation benefit perception.

Participants argued that for them to take full benefit from the provided personalised nutrition advice (Stage 3 of the personalised nutrition information exchange process), a personalised nutrition service should aim at changing an individuals' lifestyle rather than merely serving as a weight loss tool. To achieve this aim, the incorporation of exercise was essential. Moreover, to increase the perception of personalisation benefits personalised nutrition should be convenient and include a level of support that stimulates advice adherence (Stage 2 of the personalised nutrition information exchange process). Participants did not agree on the way in which advice adherence should be stimulated. The desirability of an advice adherence strategy depended on the extent to which the strategy was perceived as risky. Some participants were, for example, not keen on support group meetings, because attending such meetings required sharing personal matters and with that giving up one's privacy. To maximise convenience and advice adherence, personalised nutrition services should be tuned to individual preferences. This finding is in line with the study of Stewart-Knox et al. (2013), which states that personalised nutrition should indeed be tailored to consumers' lifestyle, motivations, and efficacy. Since attempts to change dietary habits often fail (Dellande, Gilly, & Graham, 2004; Teixeira, Silva, Mata, Palmeira, & Markland, 2012), paying attention to individual needs regarding advice adherence may prove vital to make engaging in personalised nutrition attractive.

Although the focus groups yielded a wealth of information, this study is not without limitations. It should be kept in mind that focus group discussions are a qualitative research method that provides purely indicative results. In addition, focus group discussions are not suitable to identify specific cross-country differences, which places cross-cultural comparison beyond the scope of this study. Hence, to identify cultural differences, quantify the results, and firm the findings a large-scale quantitative data collection stream is required. Furthermore, the fact that lay-out, wording and price differed across the nine flyers used as stimulus material may have influenced participants' opinions regarding the different personalised nutrition services. However, since the two most (79%) and two least (58%) appreciated services accounted for a large proportion of participants' preferences for personalised nutrition services, we can assume that the effect of flyer lay-out, wording, and price was limited. Furthermore the group discussions did not give the impression that participants placed greater importance on lay-out and wording than on content. Using different lay-outs and wordings may, however, have helped participants to perceive the flyers as different personalised nutrition services, making ranking easier, more realistic, and more useful.

3.5. Conclusion

This study provides an initial insight into how attributes of the personalised nutrition information exchange process influence consumer adoption of personalised nutrition. The qualitative results confirm that disclosing personal information in order to receive

personalised nutrition advice may encounter resistance due to a high perception of privacy risk (i.e. DNA) and/or a low perception of personalisation benefit (i.e. dietary intake and DNA). This finding supports the assumption that consumers evaluate personalised nutrition services according to a privacy calculus. Adoption of personalised nutrition could be increased if in its positioning services that offer personalised nutrition would account for attributes that reduce privacy risk perception and amplify personalisation benefit perception. This study suggests that to do so, personalised nutrition services should include face-to-face communication, exercise in addition to diet, and trustworthy expert advice providers. Furthermore, it is important to include service attributes that increase advice adherence. Even though including such attributes would most likely amplify benefit perception, advice adherence strategies that are not in line with consumers' needs may have the opposite effect or even increase risk perception. Hence, service attributes that enhance advice adherence should be tailored to the needs of specific consumer segments. Above all, consumers' benefit perception of personalised nutrition could be amplified by contextualising personalised nutrition services as lifestyle instead of dietary advice focused.

Cognitive process behind the adoption of personalised nutrition advice

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Abstract

Objective: Through a privacy calculus (i.e. risk-benefit trade-off) lens, this study identifies factors that contribute to consumers' adoption of personalised nutrition services. We argue that consumers' intention to adopt personalised nutrition services is determined by perceptions of privacy risk, personalisation benefit, information control, information intrusiveness, service effectiveness, and the benevolence, integrity, and ability of a service provider.

Method: Data were collected in 8 European countries using an online survey and analysed by means of structural equation modelling.

Results: Findings confirmed a robust and Europe-wide applicable cognitive model showing that consumers' intention to adopt personalised nutrition services depends more on perceived personalisation benefit than perceived privacy risk. Perceived privacy risk was mainly determined by perceptions of information control, whereas perceived personalisation benefit primarily depended on perceived service effectiveness. Services that required increasingly intimate personal information, and in particular DNA, raised consumers' privacy risk perceptions, but failed to increase perceptions of personalisation benefit.

Conclusion: To successfully exploit personalised nutrition, service providers should convey a clear message regarding the benefits and effectiveness of personalised nutrition services. Furthermore, service providers may reduce privacy risk by increasing consumer perceptions of information control. To enhance perceptions of both information control and service effectiveness, service providers should make sure that consumers perceive them as competent and reliable.

4.1. Introduction

Research within the field of nutrigenomics has raised high expectations, as increased understanding of the genes-nutrition relationship holds the potential to revolutionise disease prevention and health promotion (Arkadianos et al., 2007; C. Williams et al., 2008). Once it has reached its maturity, nutrigenomics offers the opportunity to prevent disease and promote health through dietary advice tailored to the individual, also referred to as personalised nutrition, rather than homogenous groups within the population (Ghosh, 2010). The urge for personalised nutrition is not surprising, as it may not only lead to the most relevant dietary advice, but also stimulate advice adherence (Hurlimann et al., 2014) through increased involvement (Lustria et al., 2009). Consumer reluctance to adopt personalised nutrition may, however, compromise the potential benefits resulting from personalised nutrition.

For consumers, enjoying the benefits of personalised nutrition is practically impossible without getting exposed to some degree of privacy risk, as personalised nutrition advice requires information regarding an individual's: 1) lifestyle (i.e. questionnaires concerning dietary intake and physical activity), 2) phenotype (i.e. current health status based on for instance a blood test), and/or 3) genetic make-up (i.e. DNA profiling based on a buccal swab) (Gibney & Walsh, 2013; Rimbach & Minihaue, 2009). Disclosing these types of personal information to a service provider that generates personalised nutrition advice implies potential negative consequences caused by privacy loss (Mothersbaugh et al., 2012). For instance, consumers may have trouble getting health insurance when their genetic information would be made known to their insurance company. Hence, consumers' willingness to disclose personal information in return for the benefits of personalised nutrition advice, while putting at risk their privacy, is considered decisive in the adoption of personalised nutrition.

Although highly relevant for the domain of nutrition and health, consumers' intention to engage in personalisation is most often studied in business-related contexts such as advertising and e-commerce (e.g. T. Li & Unger, 2012; D. G. Taylor, Davis, & Jilapalli, 2009; van Doorn & Hoekstra, 2013). Due to a difference in the intimacy level of the required personal information (e.g. demographics and purchase history vs. health information), it cannot be assumed that the findings from the business context are fully applicable to personalised nutrition. Hence, to successfully exploit personalised nutrition, knowledge on factors that contribute to consumers' adoption of personalised nutrition is required. The current study, therefore, aims to provide insight into determinants of consumers' intention to adopt personalised nutrition.

4.1.1. Theoretical framework

The theoretical framework (Figure 4.1) of this study proposes consumers' intention to adopt personalised nutrition to be determined by the shared impact of risk and benefit perceptions (Berezowska et al., 2014) (Chapter 3). The balance between desired benefits and undesired risks is assessed by combining risk and benefit perceptions into an overall information disclosure valuation (Y. Li, 2012), captured by the privacy calculus (Culnan & Armstrong, 1999). The privacy calculus builds on the principles of behavioural decision making theories (e.g. Blau, 1964; Kahneman & Tversky, 1979; Vroom, 1964) 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, Thompson, Hale, Lowry, & Greer, 2013). Hence, consumers will only be willing to adopt personalised nutrition, rather than general dietary advice, if the perceived benefits of information disclosure offset the perceived risks of information disclosure (Dinev & Hart, 2006). When the outcome of the privacy calculus is positive (i.e. perceived benefits are greater than perceived risks), 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 perceived risks) is likely to result in the rejection of personalised nutrition (Heng Xu, Luo, Carroll, & Rosson, 2011). Therefore, we hypothesise that:

Hypothesis 1. The more positive the outcome of the privacy calculus, the more likely consumers are to adopt personalised nutrition 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 personal value that consumers perceive to receive in return for information disclosure (Chellappa & Sin, 2005). The value of personalised nutrition is, amongst others, based on the extent to which an individual expects that using personalised nutrition will help him/her to attain a particular goal (e.g. improve health) (Sweeney & Soutar, 2001). Consumer perceptions of value, therefore,

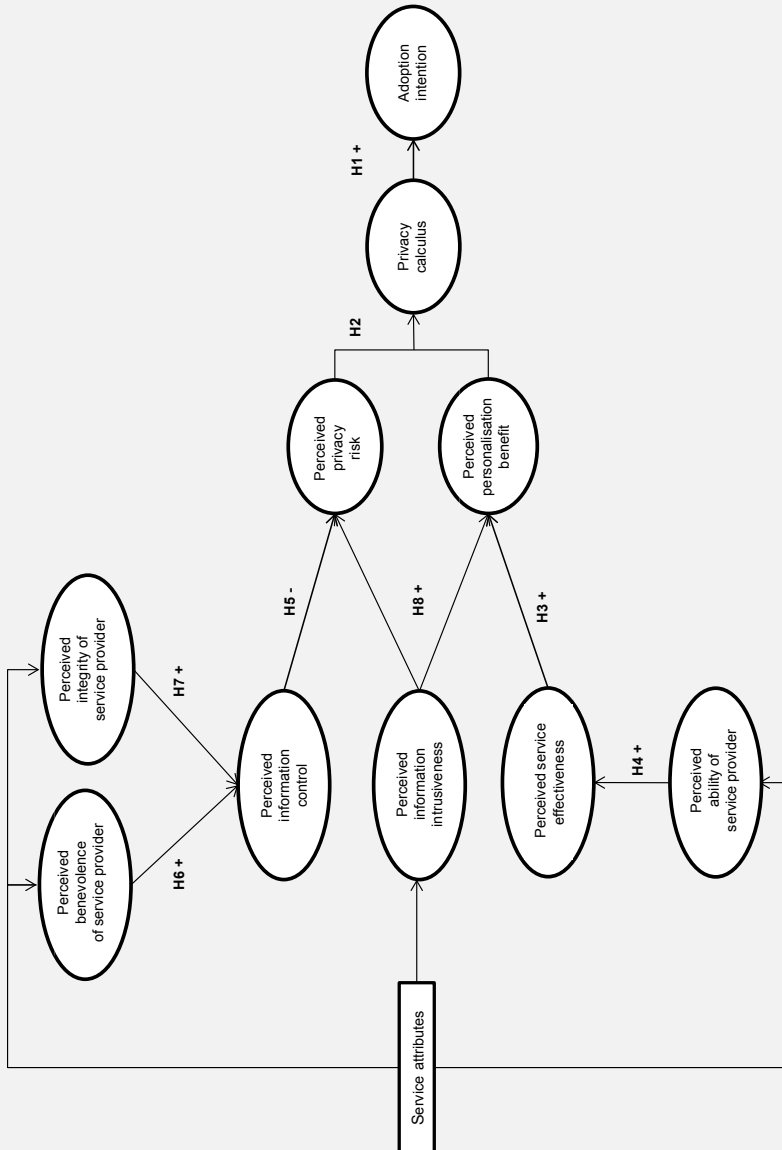


Figure 4.1. Theoretical framework

depend on the effectiveness of personalised nutrition, which is rooted in concepts such as usefulness (Davis, 1989) and expected performance (Venkatesh, Morris, Davis, & Davis, 2003). The extent to which consumers perceive engaging in personalised nutrition as effective is affected by a service provider's ability to transform the acquired personal information into a tailored and useful advice. That is to say, believing that a service provider is able to transform personal information into effective personalised nutrition advice assures consumers that engaging in personalised nutrition will enable them to achieve their goal (Earle, 2010; Siegrist, Gutscher, & Earle, 2005). 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 with increasing perceptions of service effectiveness.

Hypothesis 4. Perceived service effectiveness increases with increasing perceptions of a service provider's ability.

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, Nowak, & Ferrell, 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), 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 with increasing perceptions of information control.

Hypothesis 6. Perceived information control increases with increasing perceptions of a service provider's benevolence.

Hypothesis 7. Perceived information control increases with increasing perceptions of a service provider's integrity.

Both privacy risk and personalisation benefit perceptions are likely to depend on the personal information that is required for personalisation to take place. Personal information allowing for personalisation varies in breadth and depth (Taddei & Contena, 2013). Information breadth denotes the quantity of the required information, whereas information depth refers to the intimacy level of the information (H. Lee, Park, & Kim, 2013). Based on the extent to which the information is perceived to approach an individual's core identity, personal information can be classified into four categories (Marx, 2005) that increase in intimacy level: 1) individual information (e.g. demographics), 2) private information (e.g. lifestyle), 3) sensitive information (e.g. health status), and 4) unique information (e.g. DNA). The more information is required and the higher the intimacy level of this information, the greater the intrusiveness of the personal information. Consumers' concern regarding information disclosure increases as personal information becomes more intrusive (Goldsmith et al., 2012; Han Li, Sarathy, & Xu, 2011; Sheehan & Hoy, 2000). At the same time, an increase in information intrusiveness leads to more effective personalised nutrition advice. Hence, the more intrusive the required personal information, 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). Consequently, we hypothesise that:

Hypothesis 8: Both perceived personalisation benefit and perceived privacy risk increase with increasing perceptions of information intrusiveness.

4

Once the cognitive process behind consumers' intention to adopt personalised nutrition has been mapped, it is important to identify factors that drive this cognitive process. Looking at personalised nutrition as an information exchange process (van Trijp & Ronteltap, 2007), it becomes clear that the cognitive process behind consumers' intention to adopt personalised nutrition is fuelled by attributes that shape the way in which personalised nutrition advice is generated and provided. 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 personalised nutrition advice; 3) the service provider provides the personalised nutrition advice to the consumer (Ronteltap et al., 2013) (Chapter 2). Although personal information remains at the heart of personalised nutrition, the information exchange process suggests that service attributes such as communication mode, service scope, and service frequency also contribute to consumers' intention to adopt personalised nutrition. Consumers may for instance be reluctant to disclose DNA to a service provider that limits himself to email communication (Metzger, 2004) or perceive information disclosure as more valuable when nutrition advice is provided more than once (Seiders, Flynn, Berry, & Haws, 2014). Since consumers' preference for and reaction to service attributes may differ from country to country (Pullman, Verma, & Goodale, 2001), to consolidate widespread adoption of

personalised nutrition it is important to identify which service attributes amplify or mitigate adoption intention across different countries.

4.2. Methods

4.2.1. Sample and procedure

To test the theoretical model, 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 gender, age, region of residence, and highest level of education completed according to the International Standard Classification of Education (UNESCO Institute for Statistics 2012). Participants' age was 41 years on average 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.

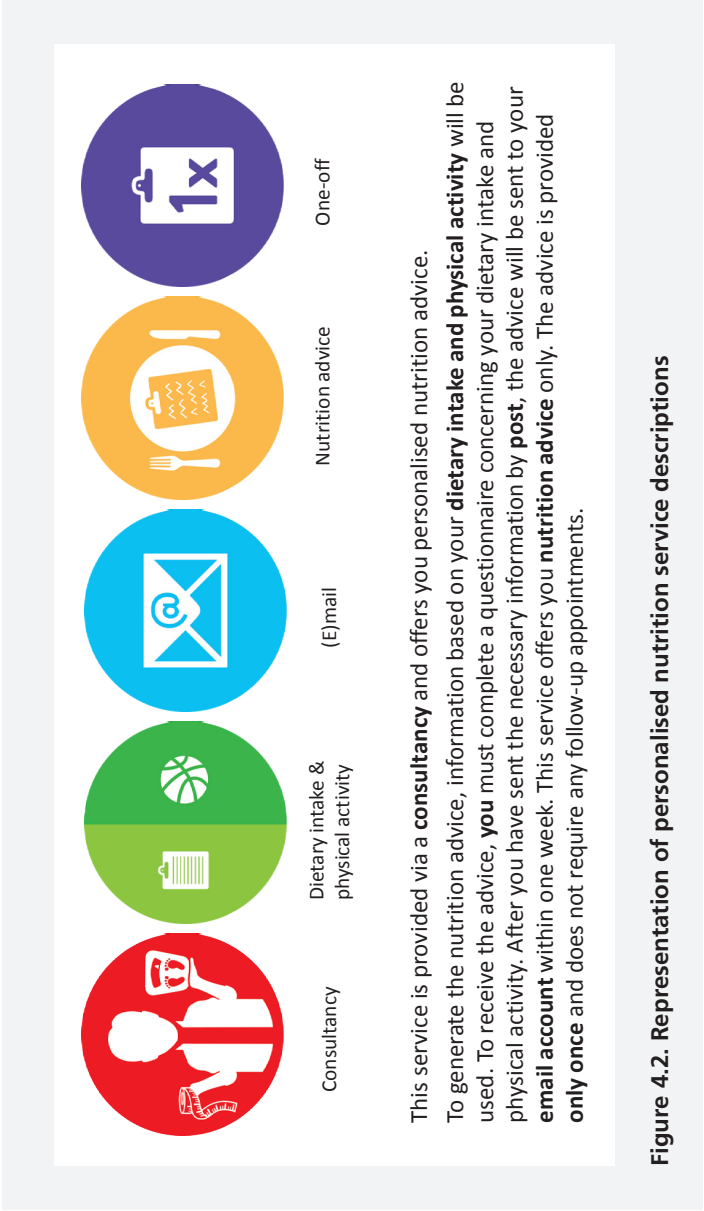
4.2.2. Stimuli

Fictitious personalised nutrition services were used as stimulus material. A total of 144 services were generated using a full-factorial design combining five service attributes (personal information with 4 levels, service provider with 3 levels, communication mode with 2 levels, advice scope with 3 levels, advice frequency with 2 levels) based on Berezowska et al. (2014) (Table 4.1) (Chapter 3). Each participant was shown two personalised nutrition services. To ensure intra-individual variance in the information intrusiveness 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 through the collection of a buccal swab, the second service had to require lifestyle information, phenotypic information through the collection of a blood sample, or the combination of phenotypic information and DNA. The service attribute levels of both personalised nutrition

services were presented to the participants using pictograms supported by textual descriptions (Figure 4.2). 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 that all services were evaluated from the same perspective, participants were instructed to imagine being in need of a service that could help them develop a healthier lifestyle.

Table 4.1. Personalised nutrition service attributes and levels

Service attribute	Service attribute levels
Personal information	<ul style="list-style-type: none"> • <i>Low quantity private information:</i> Lifestyle • <i>Mid quantity sensitive information:</i> Lifestyle + Phenotype • <i>Mid quantity unique information:</i> Lifestyle + DNA • <i>High quantity unique information:</i> Lifestyle + Phenotype + DNA
Service provider	<ul style="list-style-type: none"> • Consultancy + dietitian • Fitness club + dietitian • Employer + dietitian
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



4.2.3. Measures

Measures were derived from existing scales adapted from prior studies (Table 4.2). As no relevant information intrusiveness scale was available, information intrusiveness items were developed based on Zwick and Dholakia (2004). All items were answered on 7-point scales ranging from strongly disagree to strongly agree or, in case of the privacy calculus, greater risks to greater benefits. The survey was pre-tested in the Netherlands using cognitive walkthrough interviews (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.

4.2.4. Data analysis

The proposed model was tested using confirmatory factor analysis and structural equation modelling with maximum likelihood estimation in the R package Lavaan (Rosseel, 2012).

First, to rule out the possibility of language causing differences between countries, the relationship between a latent construct and its items (i.e. measurement model) was assessed through a multi-group confirmatory factor analysis. Using one-factor models, cross-national equivalence of the employed measures was established on the basis of three consecutive tests (Steenkamp & Baumgartner, 1998) for each latent construct individually. Test 1 checked whether the items of a particular measure loaded on the same latent construct in all countries, meaning that the conceptual definition of a latent construct was similar across countries (i.e. configural invariance). Test 1 was conducted for perceived benevolence of service provider only, given that, in the light of model identification, assessing configural invariance for one-factor models is solely meaningful when construct scales consist of at least four items (Brown, 2006). Test 2 assessed whether the factor loadings of a particular item were equal across countries, indicating that a latent construct has the same meaning in all countries (i.e. metric invariance). Test 3 established whether the average item scores were equivalent across countries, showing that response patterns were equal across countries (i.e. scalar invariance). When cross-national equivalence was not reached, parameters related to configural, metric, and/or scalar invariance were relaxed based on the modification indices.

Second, to determine whether scalar invariance could be assigned to the overall measurement model, Test 3 was repeated using a multi-factor model consisting of all latent

Table 4.2. Measures

Construct	Adapted from	Question	Items	Anchors
Adoption intention	Zarpou, Saprikis, Markos, and Vlachopoulou (2012) / S. 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"
Information intrusiveness	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 his/her 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 his/her word tries to be fair in dealing with others is guided by sound principles 	1 = "Strongly disagree" to 7= "Strongly agree"
"Service 1" was replaced with "Service 2" when evaluating the second personalised nutrition service description				

constructs and their items, while accounting for the relaxations suggested by the one-factor models.

Third, internal consistency of the latent constructs was evaluated on the basis of two reliability checks: 1) ω^2 , adequate when $>.7$ (Nunnally, 1978); and 2) average variance extracted (AVE), adequate when $>.5$ (Fornell and Larcker 1981). Discriminant validity (i.e. the extent to which the measured constructs are distinct) was confirmed when the shared variation between a construct and its items (i.e. AVE) exceeded the shared variance between that particular construct and each of the other constructs (Fornell & Larcker, 1981).

Fourth, the causal relations between the latent constructs (i.e. structural model) were assessed. To identify differences and similarities between countries, a multi-group structural equation model was performed. The structural model was tested in six steps that consecutively added equality constraints across countries: Step 1) strength of causal relation (i.e. path coefficient or β) between latent constructs is allowed to vary across countries; Step 2) strength of causal relation between latent constructs is not allowed to vary across countries; Step 3) variances and covariances among exogenous latent constructs ability, benevolence, integrity, and information intrusiveness are not allowed to vary across countries; Step 4) regression intercepts for information control, service effectiveness, privacy risk, personalisation benefit, privacy calculus, and adoption intention are not allowed to vary across countries; Step 5) means for ability, benevolence, integrity, and information intrusiveness are not allowed to vary across countries; Step 6) the extent to which an explanatory variable explains an outcome variable is not allowed to vary across countries (i.e. R^2).

To determine whether both the measurement model and structural model were equal across countries, model fit was assessed based 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 $<.08$; 3) Comparative Fit Index (CFI), good if $>.95$; 4) Tucker-Lewis index (TLI), good if $>.95$. The adopted cut-off values were derived from Hair, Black, and Babin (2010).

To evaluate the main effects of the service attributes corrected for population variance, 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 with the service attributes as explanatory variables and privacy risk, personalisation benefit, privacy calculus, and adoption intention as outcome variables.

4.3. Results

4.3.1. Measurement model

To rule out the possibility of language causing differences between countries, the relationships between the different latent construct and their items were subjected to several tests. Partial configural invariance was confirmed for perceived benevolence of service provider, implying that its conceptual definition was similar across countries (Table 4.3). 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 his/her way to help). Metric invariance was achieved for all multi-item constructs, except perceived benevolence of service provider, indicating that the latent constructs 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. Demonstrating equal response patterns across countries, scalar invariance was achieved for perceived integrity of service provider, perceived ability of service provider, perceived information control, perceived information intrusiveness, perceived service effectiveness, perceived privacy risk, and perceived personalisation benefit. After relaxing some equality constraints (see Table 4.3), partial scalar invariance was also 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 all constructs except perceived benevolence of service provider (RMSEA=.079) and adoption intention (RMSEA=.076). These RMSEA values could, however, be considered sufficiently close to good fit at this stage (Baumgartner & 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 construct and the item, the error variance of the single-item construct privacy calculus was set to 20% (Fuchs & Diamantopoulos, 2009).

Table 4.3. Fit measures for the one-factor multi-item models and the overall measurement model

	Scalar invariance	χ^2	Df	CFI	TLI	RMSEA		SRMR
						Value	90% LB 90% UB	
One-factor models								
Adoption intention	Partial ¹	344.92	27	.992	.992	.076	.069 .083	.030
Personalisation benefit	Yes	90.50	28	.999	.999	.330	.026 .041	.013
Privacy risk	Yes	208.01	28	.997	.997	.056	.048 .063	.018
Information intrusiveness	Yes	219.54	28	.996	.996	.058	.051 .065	.027
Service effectiveness	Yes	79.57	28	.999	.999	.030	.022 .028	.010
Information control	Yes	275.22	28	.994	.995	.066	.059 .073	.034
Ability of service provider	Yes	107.63	28	.999	.999	.037	.030 .045	.011
Benevolence of service provider	Partial ²	692.80	51	.988	.988	.079	.074 .084	.048
Integrity of service provider	Yes	211.13	28	.996	.997	.057	.050 .064	.019
Overall measurement model	Partial ³	14264.38	2922	.980	.977	.044	.043 .044	.032

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

²Model 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.

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

Since the CFI, TLI, RMSEA, and SRMR values for the overall measurement model indicated good fit (Table 4.3), 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 .888 to .969. The AVE values ranged from .712 to .913. Discriminant validity was adequate across all constructs except benevolence of the service provider. 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) AVE for integrity of the service provider (.816-.876) being considerably larger than the between-construct variance (.757-.799), and 3) almost identical values of the AVE for benevolence of the service provider (.712-.772) and the between-construct variance (.757-.799), it was decided that benevolence of the service provider and integrity of the service provider would not be merged.

4.3.2. Structural model

Table 4.4 shows the fit measures for the six consecutive steps based on which differences and similarities between the causal relations across countries were assessed. 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 adjust the model.

Correlations between ability of service provider, benevolence of service provider, integrity of service provider and information intrusiveness were high and ranged from .64 to .87 ($p < .001$).

4.3.3. Hypothesis testing

The first important finding is the fact that all hypothesised relations were significant and equal across countries (Figure 4.3). In addition, the extent to which the model explained information control, service effectiveness, personalisation benefit, privacy calculus, and adoption intention was substantial, as the proportions of explained variance ranged from 36% to 70%. With 8%, the explained variance of perceived privacy risk was modest.

As expected based on Hypothesis 1, adoption intention was determined by the outcome of the privacy calculus. The more positive the outcome of the privacy calculus the higher participants' intention to adopt personalised nutrition services ($\beta = .60$; $p < .001$).

Table 4.4. Fit measures for the six steps of the structural equation model

Step	χ^2	Df	CFI	TLI	RMSEA		SRMR
					Value	90% UB	
1. Varying path coefficients ¹	26957.51	4954	.960	.957	.047	.047	.089
2. Equal path coefficients	27746.81	5276	.959	.959	.046	.046	.093
3. Equal (co-) variances among ability, benevolence, integrity, information intrusiveness	28454.41	5346	.958	.958	.046	.047	.102
4. Equal regression intercepts	29523.92	5381	.956	.957	.047	.047	.099
5. Equal means ability, benevolence, integrity, information intrusiveness	29960.09	5409	.956	.955	.047	.048	.101
6. Equal R ²	30879.62	5451	.954	.955	.048	.048	.102

¹Step 1 included covariances between ability, benevolence, integrity, and information intrusiveness

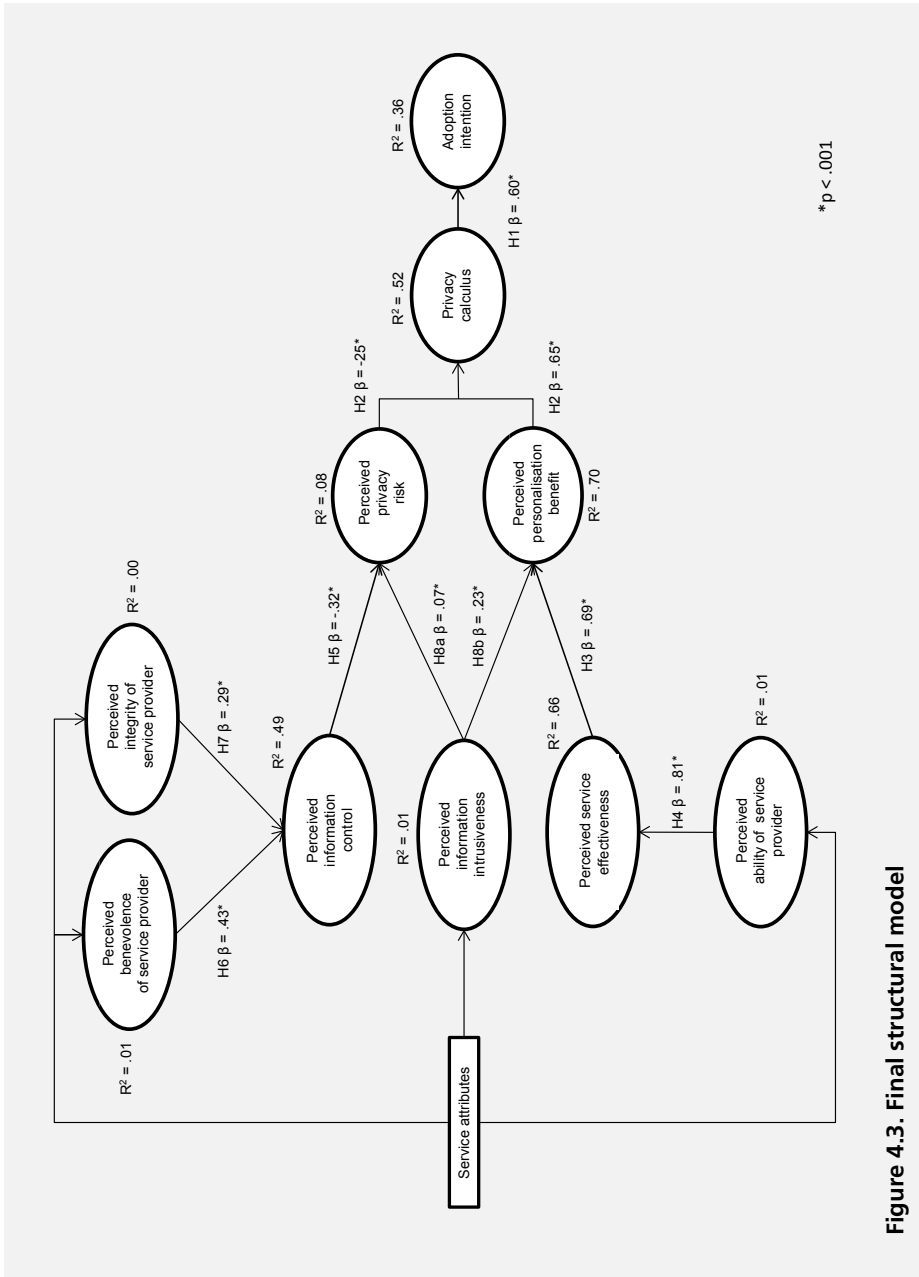


Figure 4.3. Final structural model

Confirming Hypothesis 2, the outcome of the privacy calculus depended on both privacy risk and personalisation benefit perceptions. Perceived privacy risk had a negative effect on the outcome of the privacy calculus ($\beta = -.25$; $p < .001$), while perceived personalisation benefit had a positive effect on the outcome of the privacy calculus ($\beta = .65$; $p < .001$). Compared to the path coefficient of privacy risk, the path coefficient of personalisation benefit was almost three times as high. Confirming Hypothesis 3 and Hypothesis 8b, perceived personalisation benefit depended on participants' perceptions of service effectiveness and information intrusiveness. Perceived service effectiveness and perceived information intrusiveness were positively related to perceived personalisation benefit, meaning that an increase in both service effectiveness ($\beta = .69$; $p < .001$) and information intrusiveness ($\beta = .23$; $p < .001$) results in higher perceptions of personalisation benefit. Comparing the path coefficients of perceived service effectiveness and perceived information intrusiveness, the effect of perceived service effectiveness on perceived personalisation benefit was three times as high. In line with Hypothesis 4, perceived service effectiveness depended on the perceived ability of the service provider. As the perceived ability of the service provider rose so did participants' perceptions of service effectiveness ($\beta = .81$; $p < .001$). In line with Hypothesis 5 and Hypothesis 8a, perceived privacy risk was affected by both perceived information intrusiveness and perceived information control. The relation between information intrusiveness and perceived privacy risk was positive ($\beta = .07$; $p < .001$), indicating that an increase in information intrusiveness caused an increase in the perception of privacy risk. The influence of perceived information intrusiveness on perceived privacy risk was, however, minor. In the case of perceived information control, participants' perception of privacy risk decreased as perception of information control increased ($\beta = -.32$; $p < .001$). Consistent with Hypothesis 6 and Hypothesis 7, perceived information control was determined by both perceived benevolence of the service provider and perceived integrity of the service provider. An increase in both benevolence ($\beta = .43$; $p < .001$) and integrity ($\beta = .29$; $p < .001$) enhanced participants' perceptions of information control.

The impact of the service attributes on the cognitive process behind consumers' intention to adopt personalised nutrition was minor. Although most of the service attributes had a significant effect on the perceived ability of the service provider, benevolence of the service provider, integrity of the service provider, and information intrusiveness, the extent to which the service attributes explained each of these latent constructs was approximately 1% (Table 4.5). Aggregated data showed that adoption intention was affected by personal information, service provider, and communication mode. The outcome of the privacy calculus was influenced 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

Table 4.5. Path coefficients of service attribute levels

Service attribute	Construct			
	<i>Ability of service provider</i>	<i>Benevolence of service provider</i>	<i>Integrity of service provider</i>	<i>Information intrusiveness</i>
Personal information				
<i>Phenotype (compared to lifestyle)</i>	.016	.003	.006	.044*
<i>DNA (compared to lifestyle)</i>	-.035	-.064**	-.085***	.045*
<i>Phenotype x DNA (compared to lifestyle)</i>	.006	-.049*	-.056*	.080***
Service provider				
<i>Fitness club (compared to consultancy)</i>	-.005	.068**	.047*	-.005
<i>Employer (compared to consultancy)</i>	-.031	-.052*	.011	-.012
Communication mode				
<i>Personal contact (compared to no personal contact)</i>	.130***	.109***	.089***	.114***
Advice scope				
<i>Nutrition + exercise (compared to nutrition only)</i>	.021	.053**	.022	.015
<i>Nutrition + exercise + support group (compared to nutrition only)</i>	-.002	.024	.011	.012
Advice frequency				
<i>Monthly (compared to one-off)</i>	.058***	.050**	.029	.047**

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

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 4.6).

Table 4.6. 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>Phenotype</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>Phenotype 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.

4.4. Discussion

This study developed and tested a comprehensive model explaining consumers' intention to adopt personalised nutrition services. Confirming all hypothesised relations, we find strong support for the proposed model. Moreover, we show that the basic model structure is generalizable to 8 European countries. Together, these findings point towards a robust and Europe-wide applicable cognitive model that predicts differences in consumers' intention to adopt personalised nutrition.

The proposed cognitive model postulates a central role for the privacy calculus in consumers' intention to adopt personalised nutrition services. Most studies that assume the privacy calculus to mediate the relationship between risk and benefit perceptions on the one hand and intention on the other, do not explicitly measure the outcome of such calculus (e.g. Dinev, Xu, Smith, & Hart, 2013; Keith et al., 2013; H. Xu & Belanger, 2013). Reasons for omitting an explicit privacy calculus measure may stem from the belief that the privacy calculus does not contribute beyond perceptions of privacy risk and personalisation benefit. The current study, however, suggests that including an explicit privacy calculus measure supports the understanding of adoption intention without affecting the explanatory power of risk and benefit perceptions. Including an explicit privacy calculus measure in addition to privacy risk and personalisation benefit measures is, therefore, recommended.

The privacy calculus depends more on consumer perceptions of personalisation benefit than on perceptions of privacy risk. The dominant role of perceived personalisation benefit is in line with the "privacy paradox" (e.g. Belanger & Crossler, 2011; Pavlou, 2011; Smith et al., 2011), which implies that consumers tend to put their privacy concerns aside if they expect information disclosure to result in attractive benefits. As most consumers perceive products and services that are tailored to their specific needs to be beneficial (e.g. Franke, Keinz, & Steger, 2009; Kalyanaraman & Sundar, 2006), it is likely that the effect of privacy risk perceptions on the privacy calculus may have been offset by perceptions of personalisation benefit.

Our findings show that disclosing increasingly intimate personal information did not result in higher perception of personalisation benefit, but did increase perceptions of privacy risk. This suggests that consumers are aware of the privacy risk that is induced by the disclosure of highly intimate personal information (i.e. DNA), but not of the personalisation benefit. In the light of the privacy calculus, this would mean that the benefits resulting from disclosing highly intimate personal information may not suffice to offset the risk associated with the disclosure of highly intimate information. Such risk-benefit balance is likely to lead consumers towards "intermediate" levels of personalised nutrition that are less intrusive but also less effective. Hence, although studies into DNA-based personalised nutrition advice report consumers to favour personalised over general nutrition advice (e.g. Nielsen & El-Sohehy, 2012; Nielsen, Shih, & El-Sohehy, 2014), we should not lose sight of the role

that privacy risk plays in consumers' intention to adopt personalised nutrition. To offset privacy risk perceptions, service providers may even need to educate consumers about the benefits of DNA-based personalised nutrition, over and above those of lifestyle- and phenotype-based personalised nutrition.

Compared to the other latent constructs included in our theoretical model, the explained variance of perceived privacy risk was modest. Reasons for this low percentage of explained variance in the privacy risk construct may be twofold. First, the applied methodology may have induced a non-committal way of consumers expressing their adoption intention, which may have inhibited participants from taking a closer look at privacy risk determinants such as information control and information intrusiveness. Hence, in situations where the decision to engage with a personalised nutrition service is no longer hypothetical (Hofstetter, Miller, Krohmer, & Zhang, 2013), the effect of perceived information control and perceived information intrusiveness on privacy risk perceptions may be larger than would be expected on the basis of the current findings (Trobe & Liberman, 2010). Second, the specific operationalization of privacy risk may have steered respondents towards privacy risk determinants related to information exchange, rather than those related to information management (I. B. Hong & Cha, 2013). Information management related privacy concerns such as unauthorised access due to inadequate information storage security (Anton et al., 2010) may provide additional insight into consumers' privacy risk perception (Cortese & Lustria, 2012; Smith, Milberg, & Burke, 1996; Zhou, 2011). Future research is recommended to include both information exchange and information management related determinants of privacy risk.

With regard to the trust dimensions (Mayer & Davis, 1999), 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. In the current analysis we followed the idea that each of the trust dimensions has a distinct contribution to the decision process (Colquitt et al., 2007; Terwel, Harinck, Ellemers, & Daamen, 2009). That is, competence-related trust dimensions may be associated with consumers' confidence in service effectiveness (Earle, 2010; Siegrist et al., 2005), 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 & Cvetkovich, 1995). Although the current findings support the idea of the different trust dimensions playing a distinct role in the decision making process, we cannot be conclusive about how the different trust dimensions are best positioned in the hypothesised model. Future research should, therefore, systematically test the relevance of each trust dimension for the different latent constructs.

Considering the extent to which the proposed constructs explained consumers' intention to adopt personalised nutrition, the overall performance of the theoretical model was good.

Compared to the latent constructs, the effect of the service attributes on adoption intention was, however, small. The difference in the extent to which the latent constructs and service attributes were able to explain adoption intention may be caused by the design of this study and participants' lack of knowledge about or relevance of personalised nutrition service attributes. Evaluating two of the 144 personalised nutrition services without being familiar with the full range of possible service attributes may have caused the within-participant measured effects of the latent constructs to dominate over the between-participant measured effects of the services attributes.

In relation to overall health, the present study examined consumers' intention to adopt personalised nutrition services based on the perceived benefits of personalised nutrition advice compared to general nutrition advice. It is important to recognise that the benefits of improved overall health, in most instances, will only materialise if consumers adhere to the provided nutrition advice. Future research is needed to better understand the drivers and barriers of adherence to personalised nutrition advice. Important in this respect is also that some health benefits may be experienced shortly after engaging with a personalised nutrition service (e.g. increase of physical fitness), while other health benefits only materialise over a longer period of time (e.g. prevention of chronic diseases). Lack of direct feedback on long-term health improvement may, however, reduce motivation to adhere to the advice. Future research should identify if and how direct feedback may contribute to advice adherence, either through directly perceivable improvements related to for instance physical performance, and/or the use of more dynamic assessments enabled by wearable devices capable of monitoring relevant biomarkers.

4.5. 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 nutrition services. For theory, the model implies that consumers' intention to adopt personalised nutrition services depends more on perceptions of personalisation benefit than on perceptions of privacy risk. At the practical level, this implication suggests that to consolidate adoption providers of services that require highly intrusive personal information such as DNA should pay attention to possible privacy risks that may keep consumers from engaging with their service. Service providers may reduce consumers' privacy risk perceptions by, where possible, using less intrusive types of personal information such as lifestyle-information and phenotypic information, or alternatively, offer the option of using pseudonyms to anonymise data. Furthermore, it is important to more strongly emphasise and communicate the benefits of engaging with personalised rather than non-personalised nutrition services, particularly how and why DNA profiling contributes to superior nutrition advice. Finally, to increase consumers' perception of personalisation benefit service providers should optimise the effectiveness of their service.

Promising tools that may help increase service effectiveness are face-to-face communication and regular meetings.

The effect of self-determination on the adoption of personalised nutrition advice

This chapter is under review as:

*Berezowska, A., Fischer, A. R. H., & van Trijp, H. C. M.
The moderating effect of motivation on health-related decision making*

Abstract

Objective: This study identifies how autonomous and controlled motivation moderate the cognitive process that drives the adoption of personalised nutrition services.

Method: Depending on their level of autonomous and controlled motivation, participants (N=3453) were assigned to one of four motivational orientations, which resulted in a 2 (low/high autonomous motivation) x 2 (low/high controlled motivation) quasi-experimental design. The cognitive process comprised perceptions of privacy risk, perceptions of personalisation benefit and their determinants.

Results: High levels of autonomous motivation strengthened the extent to which: 1) the benefits of engaging with a personalised nutrition service determined the outcome of a risk-benefit trade-off; 2) the effectiveness of a personalised nutrition service determined the benefits of engaging with such service. High levels of controlled motivation influenced the extent to which: 1) the risk of losing one's privacy determined the outcome a risk-benefit trade-off; 2) having control over personal information after disclosure and perceiving the disclosed personal information as sensitive determined the risk of potential privacy loss.

Conclusion: To encourage the use of personalised nutrition services as a disease prevention-tool, it is important to not only account for the decision-making process that leads to adoption, but also for how individuals' motivational orientation affects this process.

5.1. Introduction

The rapid increase in health care spending is a major concern for many countries around the world (e.g. Joumard, Andre, & Nicq, 2010). One of the main drivers of growing health care spending is the gradually rising number of chronically-ill, which fosters an increased use of innovative diagnostic tools, treatments, and aftercare to improve patients' life expectancy and well-being (Economist Intelligence Unit, 2011; UCL, 2011). Poor dietary choices are a key contributor in the development and progression of chronic diseases (Lette et al., 2014; Swinburn et al., 2011). Hence, the general public making healthy dietary choices in order to prevent or at least delay the onset of chronic disease may contribute to reducing health care spending and improve well-being at later age.

A promising tool that provides guidelines for healthy dietary choices are personalised nutrition services. Personalised nutrition services generate dietary advice based on information related to an individual's health status, lifestyle and/or genetic make-up in order to prevent disease and optimise health (Gibney & Walsh, 2013). Entrusted with intimate and privacy-sensitive information resulting from individual diagnostic assessments, personalised nutrition services provide nutrition advice that closely fits an individual's health needs (Ronteltap et al., 2013) (Chapter 2). The health benefits embedded in personalised nutrition advice will, however, only materialise if individuals are willing to adopt personalised nutrition services (Berezowska, Fischer, Ronteltap, van der Lans, & van Trijp, 2015) (Chapter 4).

Recent research outlines a robust and Europe-wide applicable cognitive process that drives individuals' intention to adopt personalised nutrition services (Berezowska et al., 2015) (Chapter 4, Figure 4.1). At the core of this process lies a cognitive deliberation in the form of a risk-benefit trade-off (i.e. privacy calculus). Resulting from the highly sensitive health information that needs to be disclosed before engaging with a personalised nutrition service, risks are posed by the consequences of potential privacy loss. Benefits stem from the fact that information disclosure leads to highly relevant nutrition advice. Perceived privacy risk decreases when individuals perceive the disclosed personal information as less intrusive and also perceive to have more control over their personal information after disclosure. Perceptions of personalisation benefit increase when individuals perceive the disclosed personal information as more intrusive and the service that provides the nutrition advice as more effective. Information control and service effectiveness are in turn determined by the trustworthiness of a service provider. That is, perceived benevolence and integrity of a service provider increase the extent to which individuals feel in control over their personal information, while perceived ability of a service provider increases individuals' confidence in the fact that engaging with a personalised nutrition service will be effective.

Preventive health behaviours such as the adoption of personalised nutrition services are only performed when people perceive sufficient motivation to do so (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). Hence, since personalised nutrition services are a

tool that supports healthy dietary choices, it is likely that individuals' intention to adopt personalised nutrition services not only depends on cognitive deliberations but also on one's motivation to eat healthily. Therefore, to increase our understanding of how to best stimulate the adoption of personalised nutrition services, this study investigates how individuals' motivation to eat healthily affects the cognitive process that drives the adoption of these services.

5.1.1. Theoretical background

Individuals' motives to eat healthily may vary. People may eat healthily because they find the behaviour itself interesting, enjoyable, and/or satisfying, which suggests that they act upon intrinsic motivation. It is, however, more likely that people eat healthily not because of the pleasure that they derive from it, but because they want to attain desired end-states such as weight loss, muscle tone, or optimal health (Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012). Eating healthily is, therefore, more likely to be perceived as a means to an end rather than an end in itself, which suggests that the need to eat healthily is related to extrinsic rather than intrinsic motivation (Levesque et al., 2007).

Although extrinsic motivation to engage in health behaviour such as healthy eating focusses on the attainment of desired end-states, the nature of extrinsic motivation differs depending on the extent to which the decision to eat healthily is self-determined (Ryan & Deci, 2000). Extrinsic motivation that is highly self-determined is called autonomous motivation, which leads to volitional actions that are fully endorsed by the individual (Deci & Ryan, 2000). Extrinsic motivation that is non-self-determined is called controlled motivation, which is the result of pressure from either external or intrapsychic forces such as shame and guilt. Prior research suggests that autonomous and controlled types of extrinsic motivation may vary independently of each other and, therefore, can be treated as two distinct dimensions of extrinsic motivation (Chemolli & Gagné, 2014). Furthermore, high levels of autonomous motivation weaken, while high levels of controlled motivation strengthen the extent to which cognitions about the self or certain actions lead to behaviour (Brannan & Petrie, 2011; Neighbors, Walker, & Larimer, 2003), which suggests that the cognitive process that drives individuals' intention to adopt personalised nutrition services is likely to be moderated by these types of motivation.

Autonomous motivation generally results in actions that promote positive behaviour such as mastering course materials (Vanthournout, Kyndt, Gijbels, & Van den Bossche, 2015), adhering to treatment (Kennedy, Goggin, & Nollen, 2004; Zuroff et al., 2007), greater physical activity (Hartmann, Dohle, & Siegrist, 2015; Rouse, Ntoumanis, Duda, Jolly, & Williams, 2011), and eating healthily (Shaikh, Vinokur, Yaroch, Williams, & Resnicow, 2011; G. C. Williams, McGregor, Zeldman, Freedman, & Deci, 2004). Individuals driven by high levels of autonomous motivation are also more likely to strive for goal progress

(Koestner, Otis, Powers, Pelletier, & Gagnon, 2008), which is associated with pursuing positive outcomes (Otis & Pelletier, 2008). Since benefits contribute to such outcomes, individuals with high levels of autonomous motivation may be more prone to focus on the benefits related to personalised nutrition services. We therefore hypothesise that:

Hypothesis 1. High levels of autonomous motivation increase the extent to which perceived personalisation benefit affects the risk-benefit trade-off.

Hypothesis 2. High levels of autonomous motivation increase the extent to which perceived service effectiveness and perceived information intrusiveness determine perceptions of personalisation benefit.

Hypothesis 3. High levels of autonomous motivation increase the extent to which perceived ability of the service provider determines perceptions of service effectiveness.

In contrast to autonomous motivation, controlled motivation is more predictive of negative behaviours related to for instance worry and anxiety (Brunet, Gunnell, Gaudreau, & Sabiston, 2015). In the context of healthy eating, controlled motivation generally leads to eating behaviours that prevent negative health outcomes (e.g. dysfunctional eating such as fasting or avoiding certain foods) (Ng, Ntoumanis, Thøgersen-Ntoumani, Stott, & Hindle, 2013; Otis & Pelletier, 2008; Pelletier & Dion, 2007; Pelletier, Dion, Slovinet-D'Angelo, & Reid, 2004). This suggests that highly controlled individuals concentrate on risk avoidance. To avoid risk and with that negative outcomes, individuals' with high levels of controlled motivation may be more prone to focus on the risks related to personalised nutrition services. We therefore hypothesise that:

Hypothesis 4. High levels of controlled motivation increase the extent to which perceived privacy risk affects the risk-benefit trade-off.

Hypothesis 5. High levels of controlled motivation increase the extent to which perceived information control and perceived information intrusiveness determine perceptions of privacy risk.

Hypothesis 6. High levels of controlled motivation increase the extent to which perceived benevolence and perceived integrity of the service provider determine perceptions of information control.

5.2. Methods

5.2.1. Measures

Measures related to the cognitive process were derived from Berezowska et al. (2015) (Chapter 4) and are shown in Table 4.2. Apart from the benevolence of the service provider (assessed with 4 items) and the privacy calculus (assessed with 1 item), all measures contained 3 items. Except for the privacy calculus, all items were answered on 7-point scales ranging from strongly disagree to strongly agree. The privacy calculus was assessed on a 7-point scale ranging from greater risks to greater benefits. All measures fulfilled the reliability requirements ($\alpha > .71$).

Autonomous motivation was measured using the 6 items of the autonomous-subscale of the "Treatment self-regulation questionnaire" (TSRQ) (Levesque et al., 2007) (Table 5.1). Controlled motivation was measured by combining the introjected (2 items) and the external (4 items) subscales of the TSRQ. All items were assessed on 7-point scales ranging from strongly disagree to strongly agree. Scores for autonomous motivation ($M=5.41$, $SD=1.37$) and controlled motivation ($M=3.59$, $SD=1.58$) ranged from 1 to 7. The scales of both autonomous and controlled motivation fulfilled the reliability requirements ($\alpha > .88$). To confirm the factorial structure of the motivation measures, a confirmatory factor analysis with autonomous and controlled motivation as latent variables was conducted. Each item loaded on its associated latent variable only. Allowing for error covariances between the controlled motivation items, the two factor structure was confirmed ($RMSEA < .06$, $SRMR < .05$; $CFI > .98$; $TLI > .97$). No items were deleted.

5.2.2. Procedure

Using a 2 (low vs. high level of autonomous motivation) x 2 (low vs. high level of controlled motivation) quasi-experimental design, data were collected from 8136 participants living in Greece, Spain, the Netherlands, Ireland, UK, Germany, Poland, or Norway by means of a cross-sectional online survey. Participants were quota sampled from the panels of a market research company 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). Data collection took place from 26 November until 20 December 2013 and was part of a larger study focussing on consumer adoption of personalised nutrition services. Response rate was 51%.

Table 5.1. Measures of autonomous and controlled motivation

Motivation	Question	Items
<i>Autonomous</i>	When I eat healthily, I do so because:	<ul style="list-style-type: none"> • I feel that I want to take responsibility for my own health • I personally believe that eating healthily is the best thing for my health • I have carefully thought about it and believe that eating healthily is very important for many aspects of my life • eating healthily is an important choice I really want to make • eating healthily is consistent with my life goals • it is very important to be as healthy as possible
<i>Controlled</i>	When I eat healthily, I do so because:	<ul style="list-style-type: none"> • I would feel guilty or ashamed of myself if I did not eat a healthy diet[†] • I would feel bad about myself if I would not eat a healthy diet[†] • others would be upset with me if I did not eat healthily[‡] • I feel pressure from others to eat healthily[‡] • I want others to approve of me[‡] • I want others to see that I can eat healthily[‡]

[†] Item of the introjected subscale[‡] Item of the external subscale

Prior to completing the measures related to the cognitive process, participants were shown a description of a fictitious personalised nutrition service. The description of the personalised nutrition service contained information regarding: 1) by whom the service was provided (3 levels); 2) whether the service was online or face-to-face (2 levels); 3) on which personal information the nutrition advice was based (4 levels); 4) what was included in the nutrition advice (3 levels); and 5) how often the nutrition advice was provided (2 levels). The different levels of each service attribute are described in Table 4.1. Each participant evaluated two of the possible 144 personalised nutrition services. Stimuli and measures were translated into the national languages of the participating countries. Translation quality was ensured by using the back-translation method (Brislin, 1970). A detailed explanation of the data-collection procedure and the stimuli is published in Berezowska et al. (2015) (Chapter 4).

5.2.3. Motivational orientation

Based on the item scores, composite scores for autonomous and controlled motivation were calculated. Using two cut-off points of 33%, scores of both autonomous and

controlled motivation were divided into the categories lowest, middle, and highest. Scores that fell on the first cut-off point were assigned to the lowest category, while scores that fell on the second cut-off point were assigned to the middle category. Doing so resulted in somewhat unequal group sizes. To avoid misclassification, and with that increase the clarity of the moderation effects, participants assigned to the 'middle' category of either autonomous or controlled motivation were excluded from further analysis, which resulted in a total of 6906 observations (3453 participants who evaluated two services). In the case of autonomous motivation lowest scores ranged from 1 to 5 ($M=4.30$, $SD=.91$), and highest scores ranged from 6.17 to 7 ($M=6.66$, $SD=.31$). In the case of controlled motivation lowest scores ranged from 1 to 3.25 ($M=2.29$, $SD=.72$), and highest scores ranged from 4.25 to 7 ($M=5.09$, $SD=.75$). Lowest and highest scores on autonomous and controlled motivation were combined into four motivational orientations: 1) "low autonomous/low controlled" ($n=2236$), 2) "high controlled/ low autonomous" ($n=1400$), 3) "low controlled/high autonomous" ($n=1460$), and 4) "high autonomous/high controlled" ($n=1810$).

5.2.4. Data analysis

Hypotheses were tested using structural equation modelling with maximum likelihood estimation in the R package Lavaan (Rosseel, 2012).

The starting point of the data analysis was the model described in Berezowska et al. (2015) (Chapter 4). Aside from some minor differences related to error covariance and intercepts in the measurement model, no cross-country differences were observed (see Chapter 4). Therefore, in the structural model country parameters were kept equal for each motivational orientation.

Fit of the measurement model (relationship between latent constructs and items) and the structural model (causal relations between latent constructs) was assessed based on four goodness of fit indices: 1) Root Mean Square Error of Approximation (RMSEA), 2) Standardized Root Mean Square Residual (SRMR), 3) Comparative Fit Index (CFI), and 4) Tucker-Lewis index (TLI). The measurement model demonstrated good fit when the values of the fit indices were: $RMSEA<.07$; $SRMR<.08$; $CFI>.92$; $TLI>.92$ (Hair et al., 2010). Considering the number of observations and the complexity of the model, in the case of the structural model model fit was acceptable when the values of the fit indices were: $RMSEA<.07$; $SRMR<.08$; $CFI>.90$; $TLI>.90$.

Differences and similarities between the four motivational orientations were identified through a multi-group structural equation model comparison. Starting from a model where all causal relations were constrained equal across the four motivational orientations, the effect of motivational orientation was tested by stepwise relaxing the imposed equality

constraints. Chi-square differences were calculated to establish whether relaxing the equality constraints improved model fit. Significant change in Chi-square when equality constraints between the four motivational orientations were relaxed provided formal evidence for differences between motivational orientations. To interpret the moderating effect of controlled motivation, autonomous motivation, and the combination of both motivations, the regression coefficients of motivational orientation were decomposed following de Jonge, van Trijp, van der Lans, Renes, and Frewer (2008). To distinguish between high and low levels of autonomous motivation, high and low levels of controlled motivation, and the interaction between controlled and autonomous motivation, one parameter was added for each effect.

5.3. Results

5.3.1. Description of the sample

Of all participants 49.9% was female. Participants' age ranged from 18-65 with a mean of 41 years. In terms of education levels, 29.9% completed tertiary education, 40.5% completed upper-secondary or post-secondary education, and 30.5% completed lower-secondary education or less. Participants who scored high on autonomous motivation were more often female, middle-aged, healthy, well educated, Greek, Spanish, Irish, and Norwegian (Table 5.2). Participants who scored high on controlled motivation were more often young, unhealthy, British, Irish, Polish, and Spanish. There were no relevant income differences between the four motivational orientations.

5.3.2. Moderating effect of autonomous and controlled motivation

The CFI (.935) and the TLI (.930) confirmed good fit of the measurement model, while the RMSEA (.076) and the SRMR (.083) showed values sufficiently close to good fit. The final structural model in which all relations, except for the ones that did not vary across motivational orientations, were relaxed showed good fit (CFI=.904; TLI=.908; RMSEA=.068; SRMR=.135). Appendix 5.1 provides the order in which relaxations took place, chi-square differences between consecutive relaxations, and the fit indices that resulted from each relaxation.

Table 5.2. Characteristics of the different motivational orientations

Descriptive variables	Low controlled/ Low autonomous		High controlled/ Low autonomous		Low controlled/ High autonomous		High controlled/ High autonomous		χ^2 (df)
	%		%		%		%		
<i>Gender</i>									
Female	41.3		43.3		60.0		57.3		188.75** (3)
<i>Age</i>									208.72** (3)
18-29	20.6		33.9		16.8		25.1		
30-39	21.1		26.0		21.8		21.9		
40-54	38.4		27.9		38.5		32.9		
55-65	19.9		12.3		22.9		20.1		
<i>Education</i>									26.04** (3)
Primary	33.3		28.3		27.5		29.7		
Secondary	42.8		38.7		49.5		36.9		
Tertiary	23.9		33.0		33.0		33.4		
<i>Income</i>									12.17* (3)
Below 0.5x modal	16.7		19.3		17.0		18.8		
0.5 - 1x modal	24.7		22.6		22.3		23.5		
1 - 1.5x modal	20.5		17.7		19.7		19.4		
1.5 - 2.5x modal	16.2		19.0		18.9		18.3		
2.5 - 4x modal	7.7		7.4		7.7		9.0		
4x modal or higher	2.6		2.4		2.7		2.8		
No answer	11.6		11.6		11.6		8.2		

<i>Health status</i>								286.87** (3)
Very unhealthy	3.0		1.1		1.6		2.2	
Unhealthy	15.3		11.1		7.5		8.5	
Neither unhealthy /	36.0		28.7		17.3		16.5	
Nor healthy								
Healthy	41.0		54.7		61.4		58.3	
Very healthy	4.7		4.3		12.2		14.5	
<i>Country</i>								533.50** (21)
Greece (n=820)	7.4		6.7		23.8		11.7	
Spain (n=900)	9.9		14.3		12.7		16.4	
the Netherlands (n=774)	15.7		11.9		9.0		7.0	
Ireland (n=856)	10.2		11.0		11.6		16.8	
UK (n=890)	12.2		17.3		7.9		14.4	
Germany (n=846)	14.9		13.0		10.5		9.7	
Poland (n=924)	13.9		18.9		7.9		12.9	
Norway (n=892)	15.8		7.0		16.3		11.2	

Note: χ^2 was obtained using multinomial logistic regression
p < 0.005* p < 0.001**

Table 5.3 reports the hypothesised moderation effects. As expected based on Hypothesis 1, high levels of autonomous motivation increased the extent to which perceived personalisation benefit determined the risk-benefit trade-off. Partially confirming Hypothesis 2, high levels of autonomous motivation increased the effect of perceived service effectiveness on perceived personalisation benefit, but did not affect the relation between perceived information intrusiveness and perceived personalisation benefit. We did not find support for Hypothesis 3, as autonomous motivation did not affect the extent to which perceived ability of the service provider determined perceived service effectiveness. High levels of controlled motivation decreased the effect of perceived privacy risk on the risk-benefit trade-off, which goes against Hypothesis 4. In line with Hypothesis 5, high levels of controlled motivation increased the effect of perceived information intrusiveness on perceived privacy risk, but decreased the effect of perceived information control on perceived privacy risk. The results did not confirm Hypothesis 6, as the effect of perceived benevolence and perceived integrity of the service provider on perceptions of information control was not moderated by controlled motivation.

In addition to the hypothesised effects, high levels of autonomous motivation decreased the effect of perceived information control and perceived information intrusiveness on perceived privacy risk. High levels of controlled motivation, on the other hand, decreased the relationship between perceived service effectiveness and perceived personalisation benefit. Furthermore, high levels of controlled motivation also decreased the extent to which perceived ability of the service provider determined perceived service effectiveness.

Two interaction effects between autonomous and controlled motivation were found. In the case of high levels of autonomous motivation and low levels of controlled motivation the effect of perceived information intrusiveness on perceived privacy risk changed from positive to negative. Furthermore, in the case of high controlled motivation and low autonomous motivation perceived service effectiveness had a lower predictive value for perceived personalisation benefit.

Except for privacy risk and the privacy calculus, the extent to which the model explained information control, service effectiveness, personalisation benefit, and adoption intention was high for all motivational orientation profiles (Table 5.4).

Table 5.3. Path coefficients of the decision making process and moderations effects of motivation

Relationship	Moderation effect ¹									
	Low controlled/ Low autonomous		High controlled/ Low autonomous		Low controlled/ High autonomous		High controlled/ High autonomous		Autonomous x Controlled	
	B		B		B		B		B	
H1 Personalisation benefit -> Privacy calculus	.62		.58		.66		.69		.08***	
H2 Service effectiveness -> Personalisation benefit	.72		.60		.70		.73		-.05*	
H2 Information intrusiveness -> Personalisation benefit	.23		.30		.20		.23			
H3 Ability of provider -> Service effectiveness	.87		.77		.81		.78		-.07**	
H4 Privacy risk -> Privacy calculus	-.21		-.20		-.27		-.20		.04*	
H5 Information control -> Privacy risk	-.32		-.12		-.47		-.22		-.13***	
H5 Information intrusiveness -> Privacy risk	.24		.25		-.11		.08		.23***	
H6 Integrity of provider -> Information control	.37		.35		.35		.34		-.26***	
H6 Benevolence of provider -> Information control	.55		.57		.55		.52		.10**	
Privacy calculus -> Adoption intention	.61		.44		.72		.60		.14***	
									-.15***	
										.02

¹For significant χ^2 differences only
p < 0.05 * p < 0.01 ** p < 0.001 ***

Table 5.4. Explained variance of the decision making process

	Low controlled/ Low autonomous	High controlled/ Low autonomous	Low controlled/ High autonomous	High controlled/ High autonomous
<i>Privacy calculus -> Adoption intention</i>	.33	.14	.45	.30
<i>Privacy risk & Personalisation benefit -> Privacy calculus</i>	.47	.29	.57	.45
<i>Information intrusiveness & Information control -> Privacy risk</i>	.08	.03	.25	.03
<i>Information intrusiveness & Service effectiveness -> Personalisation benefit</i>	.74	.50	.68	.62
<i>Integrity of provider & Benevolence of provider -> Information control</i>	.47	.43	.41	.49
<i>Ability of provider -> Service effectiveness</i>	.67	.54	.58	.65

5.4. Discussion

This study showed how autonomous and controlled motivation to eat healthily affect the cognitive process that leads to the adoption of personalised nutrition services. The results indicate that high levels of autonomous motivation increase the weight of causal relations related to benefit perceptions and decrease the weight of causal relations related to risk perceptions. The opposite is the case for controlled motivation, where high levels of controlled motivation increase the weight of causal relations related to risk perceptions and decrease the weight of causal relations related to benefit perceptions.

The finding that the weight of benefit-related relations increases when the weight of risk-related relations decreases (and vice versa) is in line with the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000), which suggests that people base their decisions on either risk or benefit perceptions. Continuing this line of reasoning, it may also be that people actively suppress risk- or benefit-related relations to prevent conflicting thoughts that lead to discomfort in the form of attitudinal ambivalence (van Harreveld, Rutjens, Rotteveel, Nordgren, & van der Pligt, 2009; van Harreveld, van der Pligt, & de Liver, 2009) or cognitive dissonance (Festinger, 1962). These explanations are supported by the counterintuitive finding that highly autonomous individuals with low levels of controlled motivation have lower perceptions of privacy risk when the required personal information becomes more intrusive.

In line with the idea that controlled individuals decrease the importance of benefit-related relations to avoid discomfort, high levels of controlled motivation decreased the extent to which perceived service effectiveness predicted perceived personalisation benefit. The relationship between perceived service effectiveness and perceived personalisation benefit was, however, significantly lower in the case of highly controlled individuals with low levels of autonomous motivation. Individuals whose drive to eat healthily results primarily from controlled motivation may, therefore, be more likely to suppress benefit-related relations than individuals whose drive to eat healthily results from both controlled and autonomous motivation. The possibility that autonomous individuals are more likely to base their adoption intention on benefits, while controlled individuals are more likely to base their adoption intention on risks suggests a link between motivational orientation and regulatory orientation. More specifically, and in line with prior research (e.g. Otis & Pelletier, 2008), highly autonomous individuals are more likely to consider the positive consequences of adoption, while highly controlled individuals are more likely to consider the negative consequences of adoption. This difference implies that autonomous individuals try to approach gains, while controlled individuals try to avoid losses. Hence, motivational orientation and regulatory orientation (i.e. gain approach and loss avoidance) (Higgins, 1997) may be interrelated. Since regulatory orientation was not measured in the current study, future research should explore the relationship between regulatory orientation and motivational orientation in more detail.

Individuals do not only differ with regard to why they eat healthily, but also with regard to the goals that they want to accomplish by eating healthily. People may for instance eat healthily because they do not want to get ill (i.e. avoid health loss), because they want to be as healthy as possible (i.e. approach health gain), or simply because they want to look at their best (Gomez et al., 2013; Higgins, 2000). Hence, goals and motivational orientation are both related to gain approach and loss avoidance. This suggests that the extent to which the decision to adopt personalised nutrition services is dominated by risks or benefits may not only depend on individuals' motivation to eat healthily but also on their health-goal. Future research should identify the effect of health-goals on adoption intention.

Autonomous and controlled motivation did not moderate the effect of the benevolence and integrity of the service provider on information control. Perceiving a service provider as a person of benevolence and integrity signifies trustworthiness (Colquitt et al., 2007; Earle, 2010). Since trustworthiness is a prerequisite to receive personally relevant advice without losing control of one's personal information, most individuals perceive disclosing personal information to a trustworthy service provider to be quite important (Berezowska et al., 2014; Stewart-Knox et al., 2013). Beliefs about the benevolence and integrity of a service provider are, therefore, equally important to all individuals regardless of their motivational orientation.

Using a tertile-split and excluding participants assigned to the 'middle' category of autonomous and controlled motivation may have reduced the representativeness of our sample. Creating a limited number of discrete groups is, however, to our knowledge the most manageable way to include interactions in complex structural equation models (T. D. Little, 2013). Future research should try to replicate the results with continuous measures of motivational orientation as a moderator. Furthermore, one should keep in mind that the current study aimed to test theoretically relevant differences between motivational orientations, rather than present a representative overview of the population. Therefore, while the current study shows that individuals' motivation to eat healthily is a significant moderator of the decision-making process that drives the adoption of personalised nutrition services the size of this effects in the general population cannot be estimated.

5.5. Conclusion

When engaging in cognitive decision making regarding the adoption of preventive dietary recommendations, individuals who eat healthily due to autonomous motivation emphasize benefit-related factors and downplay risk-related factors. Individual who eat healthily due to controlled motivation, on the other hand, emphasize risk-related factors and downplay benefit-related factors. Although overall benefit perceptions remain the main determinant of adoption, it seems that depending on an individual's motivation to eat healthily the decision to adopt preventive dietary recommendations rests on different beliefs.

Appendix 5.1. Fit measures for the six steps of the structural equation model analysis

Step	χ^2 (df)	$\Delta\chi^2$ / Δ df	CFI	TLI	RMSEA		SRMR	
					<i>Value</i>	<i>90% LB</i>	<i>90% UB</i>	
0. Equal R^2	49916.20 (22179)		.880	.884	.076	.075	.077	.280
1. Relax variances of information control, service effectiveness, privacy risk, personalisation benefit, privacy calculus, adoption intention	48477.48 (22161)	1438.70*** / 18	.886	.890	.074	.073	.075	.269
2. Relax means ability, benevolence, integrity, information intrusiveness	46722.15 (22149)	1755.30*** / 12	.893	.897	.072	.071	.071	.215
3. Relax regression intercepts	45586.47 (22134)	1135.70*** / 15	.898	.902	.070	.069	.071	.213
4. Relax (co-) variances among ability, benevolence, integrity, information intrusiveness	44466.87 (22104)	1119.60*** / 30	.903	.906	.068	.068	.069	.141
5. Relax path coefficients of:								
a. Privacy calculus on adoption intention	44418.85 (22101)	48.02*** / 3	.903	.907	.068	.067	.069	.141
b. Privacy risk on privacy calculus	44407.83 (22098)	11.02* / 3	.903	.907	.068	.067	.069	.141
c. Personalisation benefit on privacy calculus	44386.41 (22095)	21.42*** / 3	.903	.907	.068	.067	.069	.141

<i>d. Information control on privacy risk</i>	44231.26 (22092)	155.14*** / 3	.904	.907	.068	.067	.069	.137
<i>e. Information intrusiveness on privacy risk</i>	44170.15 (22089)	61.11*** / 3	.904	.907	.068	.067	.069	.136
<i>f. Service effectiveness on personalisation benefit</i>	44146.94 (22086)	23.21*** / 3	.904	.908	.068	.067	.069	.136
<i>g. Information intrusiveness on personalisation benefit</i>	44140.06 (22083)	6.89 / 3	.904	.908	.068	.067	.069	.136
<i>h. Integrity of provider on information control</i>	44146.13 (22083)	0.81 / 3	.904	.908	.068	.067	.069	.136
<i>i. Benevolence of provider on information control</i>	44145.37 (22083)	1.58 / 3	.904	.908	.068	.067	.069	.136
<i>j. Ability of provider on service effectiveness</i>	44125.38 (22083)	21.56*** / 3	.904	.908	.068	.067	.069	.135

Note: To calculate χ^2 difference between models, the model of interest (e.g. 5g) was compared to the model that preceded it (e.g. 5f). When the χ^2 difference between the two models was non-significant, the model that precedes the model of interest remained the reference for following comparisons.
 $p < 0.05$ * $p < 0.01$ ** $p < 0.001$ ***

The effect of regulatory focus on the adoption of personalised nutrition advice

This chapter is submitted as:

*Berezowska, A., Fischer, A. R. H., & van Trijp, H. C. M.
The interplay between regulatory focus and temporal distance in the health context*

Abstract

Objective: This study identifies how the interaction between temporal distance, regulatory focus, and framing of health outcomes affects individuals' intention to adopt nutritional recommendations.

Method: In two experiments with samples of 236 and 242 students, a 2 (temporal distance: immediate health outcomes vs. delayed health outcomes) x 2 (regulatory focus: prevention vs. promotion) x 2 (health outcome framing: illness prevention vs. health promotion) full factorial between subjects design was used. Regulatory focus was manipulated by asking participants to describe which academic outcomes they wanted to either achieve or prevent and how they aimed to do this. Temporal distance and health outcome framing were manipulated by modifying descriptions of personalised nutrition services. To study the process through which temporal distance, regulatory focus, and health outcome framing affect adoption intention, measures of perceived privacy risk and perceived personalisation benefit were included as mediators.

Results: The interaction between temporal distance and regulatory focus had a significant effect on adoption intention, perceived privacy risk and perceived personalisation benefit. In the case of a prevention focus adoption intention was higher, perceived personalisation benefit was higher, and perceived privacy risk was lower when health outcomes were immediate instead of delayed. These effects were not significant for promotion focused individuals. Health outcome framing hardly had an effect on the interaction between temporal distance and regulatory focus. Only perceived personalisation benefit served as a mediator.

Conclusion: Tailoring temporal distance to individuals' regulatory focus increases adoption intention, and consequently is a useful way to stimulate the adoption of nutritional recommendations.

6.1. Introduction

Eating healthily is important for current and future health. Although most individuals recognise the importance of a healthy diet, their intention to eat healthily does not necessarily translate into healthy food choices (Bouwman et al., 2009). One of the reasons why individuals may experience difficulty with making healthy food choices is that the benefits of such choices do not outweigh their costs (Chapman & Elstein, 1995). Eating healthily often comes at the cost of eliminating tasty but unhealthy foods from one's diet. The benefits of such food choices manifest themselves in the long-term through the possibility of health maintenance (Adams & Nettle, 2009). Considering the process of temporal discounting, long-term health benefits are likely to be perceived as less valuable in the present (Story, Vlaev, Seymour, Darzi, & Dolan, 2014), which may lead to a situation where the perceived benefits of healthy food choices do not outweighing the perceived costs. The construal derived from health as a temporally distant phenomenon may, therefore, impact the cost-benefit trade-off that is inherent to decision making and individuals' motivation to adopt a healthy diet.

Individuals' motivation to adopt a healthy diet is not only affected by the trade-off between present or future costs and benefits, but also by the health goal that individuals want to accomplish. Individuals engage in health behaviour to prevent illness and/or to promote health (Gomez et al., 2013). Which of the two health goals is most salient depends on an individual's regulatory orientation, known as regulatory focus (Higgins, 1997). In the case of a prevention focus goals are driven by the need for safety and security, while in the case of a promotion focus goals result from the need for accomplishment and advancement (Higgins, 2000). Consequently, prevention-focused individuals may be more oriented towards the prevention of illness, whereas promotion-focused individuals may be more oriented towards the promotion of health. Regulatory focus is a so-called trait with state properties (e.g. Motyka et al., 2014), which implies that individuals are chronically more focussed on either prevention or promotion (i.e. personality trait), but that their focus may shift depending on the specific situation or context (i.e. situation dependent state). Hence, the effect of regulatory focus on goal attainment is likely to depend on both one's personality and the situation.

Prior studies suggest that temporal distance and regulatory focus are interrelated (Mogilner, Aaker, & Pennington, 2008; Pennington & Roese, 2003). More specifically, a prevention focus is associated with low temporal distance (i.e. present), while a promotion focus is associated with high temporal distance (i.e. future). Moreover, it is likely that in some situations a fit between regulatory focus and temporal distance increases the perceived importance of an event or object (Steinhart, Mazursky, & Kamins, 2013). Considering that both regulatory focus and temporal distance are relevant for the attainment of health goals, it may be that individuals' intention to attain a health goal increases when the temporal distance of that health goal fits one's regulatory focus. If and

how the interplay between regulatory focus and temporal distance affects health goal attainment is, however, unclear.

The attainment of health goals is likely to result from a cognitive decision making process that determines individuals' intention to act (Berezowska et al., 2015) (Chapter 4). Since regulatory focus and temporal distance are interrelated in their effect on health goal attainment, this effect is likely to be mediated by a cognitive decision making process that determines individuals' intention to attain health goals. Currently, little is known about the cognitive process through which the interplay between regulatory focus and temporal distance affect goal attainment. Understanding the cognitive process through which the interplay between these two constructs affects goal attainment may provide novel insights regarding the design of successful health interventions, and consequently induce greater behavioural change. To increase our understanding of the cognitive process that mediates the effect of regulatory focus and temporal distance on goal attainment, the aim of this study is twofold. First, it will determine how a fit between temporal distance and regulatory focus affects individuals intention to adopt a healthy diet. Second, it will identify the cognitive process through which a fit between temporal distance and regulatory focus affects individuals' intention to adopt a healthy diet.

In the context of healthy dietary choices, two cognitive factors that may mediate the effect of the interplay between regulatory focus and temporal distance on goal attainment are perceptions of risk and perceptions of benefit. Individuals' intention to adopt a healthy diet is determined by attitude (Poinhos et al., 2014), of which risk and benefit perceptions are two vital components (Berezowska et al., 2014; Berezowska et al., 2015; Ronteltap et al., 2007). The extent to which individuals perceive risks and benefits depends on whether the outcomes of their actions concern the present or the future (Eyal, Liberman, Trope, & Walther, 2004). More specifically, as temporal distance increases (i.e. behavioural outcomes lie further in the future) risk perceptions decrease and benefit perception increase. Furthermore, it seems that prevention-focused individuals are more likely to focus on risks, while promotion-focused individuals are likely to focus on benefits (Wallace & Chen, 2006; Werth & Forster, 2007). Hence, based on these findings it stands to reason that the effect of the interplay between temporal distance and regulatory focus on adoption intention is (at least partly) mediated through individuals risk and benefit perceptions.

Individuals' intention to adopt a healthy diet may differ depending on whether the recommendations are framed in terms of gains or non-losses. Regulatory focus theory suggests that promotion-focused individuals are more likely to adopt health interventions that are framed in terms of gains and prevention-focussed individuals are more likely to adopt health interventions that are framed in terms of non-losses (Cesario, Grant, & Higgins, 2004; J. Hong & Lee, 2008; Spiegel, Grant-Pillow, & Higgins, 2004). The evidence for this regulatory fit effect is, however, mixed as shown in a recent paper by Ludolph and Schulz (2015). To identify whether framing affects the interaction between temporal

distance and regulatory focus, this study frames health outcomes in terms of health promotion (i.e. gain) or illness prevention (i.e. non-loss).

To investigate the interplay between temporal distance, regulatory focus, and health outcome framing in the context of healthy eating, personalised nutrition was selected as a case. Personalised nutrition builds on the premise “tell me who you are, and I will tell you which foods are good/bad for you” (Ronteltap et al., 2013). To obtain personalised nutrition advice individuals have to disclose personal and potentially sensitive health information (e.g. Gibney & Walsh, 2013), which affects both risk and benefit perceptions. That is, disclosing sensitive information not only leads to benefits in the form of highly relevant nutrition advice (i.e. personalisation benefit), but also to risks in the form of potential privacy loss (i.e. privacy risk) (Berezowska et al., 2015) (Chapter 4). More specifically, to obtain the best possible nutrition advice, individuals have to accept the possibility that their personal information may fall into the hands of unauthorised third parties such as insurance companies. The prominent role of risks and benefits makes personalised nutrition a suitable case to further increase our understanding of the cognitive process behind individuals intention to adopt a healthy diet.

6.2. Methods Study 1

6.2.1. Design and sample

The study followed a 2 (temporal distance: immediate health outcomes vs. delayed health outcomes) x 2 (health outcome framing: prevent illness vs. promote health) x 2 (regulatory focus: prevention vs. promotion) full factorial between subjects design. Participants were 236 Dutch (under)graduate students from different disciplines of Wageningen University. The age of the participants ranged from 17 to 28 ($M=21.7$, $SD=1.92$), 34% of the sample was male. Data were collected late spring 2015.

6.2.2. Manipulations, stimuli, and measures

Temporal distance and health outcome framing were manipulated by creating a series of flyers that represented fictitious personalised nutrition services. Temporal distance was manipulated by making the flyer state that engaging with the service would provide health outcomes for the upcoming summer (i.e. immediate health outcomes) or after one has turned 50 years old (i.e. delayed health outcomes). Health outcome framing was manipulated by varying the health outcomes that were provided by a personalised nutrition service. In the case of the prevent illness frame the service offered to prevent fatigue in the

summer or health problems after one was 50 years old. In the case of the promote health frame the service offered to increase energy levels in the summer or feel full of energy after one was 50 years old. To control for the effect of flyer lay-out, two lay-outs were randomly applied (Appendix 6.1). To elicit benefit perceptions, the flyers stated that the personalised nutrition advice was provided by a qualified dietitian and based on innovative techniques that significantly increased advice effectiveness when compared to regular dietary advice. To prompt perceptions of privacy risk the flyers stated that one of the innovative techniques was DNA-analysis and that the nutrition advice was refunded by one's health insurance company, which suggests that an insurer may access one's genetic profile to use it for other purposes than initially intended. As this study aimed to investigate the cognitive process that mediates the effect of temporal distance and regulatory focus on adoption intention, rather than establishing individuals risk and benefit perceptions, no in-depth explanation of personalised nutrition was provided.

Regulatory focus was manipulated by following the procedure established by Lockwood, Jordan, and Kunda (2002). To induce a promotion focus participants were asked to write a short statement on which positive academic outcomes they wanted to achieve and how they wanted to achieve those outcomes. To induce a prevention focus participants were asked to write a short statement on which negative academic outcomes they wanted to prevent and how they wanted to prevent those outcomes.

Adoption intention was measured on a seven-point scale ranging from strongly disagree to strongly agree using three items: 1) I would consider using this service; 2) I intend to use this service, 3) I would recommend this service to others (Berezowska et al., 2015), with a α of .89.

6.2.3. Procedure

Participants were welcomed into a classroom and seated at one of the available computers. Participants were told that they would participate in a study consisting of several parts. The first part had an unrelated topic. In the second part, participants were randomly assigned to one of the two regulatory focus conditions. In the third part, participants were randomly presented with one of the four personalised nutrition service flyers³ and stated their intention to adopt the service that it described. Finally, participants reported their gender, age and field of study. Participants received a snack to compensate their effort. The study fulfilled the requirements of the Wageningen University Code of Conduct, and written consent was obtained from all participants.

³ Participants were also shown a second personalised nutrition service flyer, but since there were indications that the evaluation of the second flyer may have been influenced by the evaluation of the first one, evaluations of the second flyer were excluded from the analysis.

6.3. Results Study 1

A factorial ANOVA showed no main effect of temporal distance ($F(1, 228) = .71, p = .40$), health outcome framing ($F(1, 228) = 2.09, p = .15$), or regulatory focus ($F(1, 228) = .70, p = .40$) on adoption intention.

There was a significant interaction effect of regulatory focus and temporal distance on adoption intention ($F(1, 228) = 12.31, p = .001$, partial $\eta^2 = .05$). Simple effects analyses showed that prevention-focused participants had a higher adoption intention when health outcomes were immediate ($M = 3.49, SE = .21$) instead of delayed ($M = 2.63, SE = .20$), ($F(1, 228) = 9.25, p = .003$). For promotion-focused participants, a trend towards higher adoption intention for delayed ($M = 3.49, SE = .21$) instead of immediate health outcomes was found ($M = 2.96, SE = .19$), ($F(1, 228) = 3.63, p = .058$). The two-way interactions between regulatory focus and health outcome framing ($F(1, 228) = 2.84, p = .093$), or temporal distance and health outcome framing ($F(1, 228) = .01, p = .91$) were not significant.

There was a significant three-way interaction between temporal distance, health outcome framing, and regulatory focus ($F(1, 228) = 5.10, p = .025$, partial $\eta^2 = .02$) (Figure 6.1). Simple effects analyses were used to interpret the two-way interaction between regulatory focus and temporal distance for the different health outcome framings. In the case of the prevent illness frame participants with a prevention-focus were more likely to adopt a personalised nutrition service when health outcomes were immediate ($M = 3.68, SE = .32$) instead of delayed ($M = 2.39, SE = .27$), ($F(1, 228) = 9.62, p = .002$). Participants with a promotion-focus, on the other hand, were more likely to adopt a personalised nutrition service when health outcomes were delayed ($M = 4.04, SE = .30$) instead of immediate ($M = 3.04, SE = .25$), ($F(1, 228) = 6.67, p = .010$). In the case of the promote health frame, the interaction between regulatory focus and temporal distance was not significant ($F's < 1.3$).

6.4. Discussion Study 1

Study 1 supports the expectation that prevention-focused individuals are more likely to prioritise health outcomes that lie in the present, while promotion-focused individuals are more likely to prioritise health outcomes that lie in the future. This difference between prevention- and promotion-focused individuals is, however, nullified when health outcomes are framed in terms of health promotion instead of illness prevention.

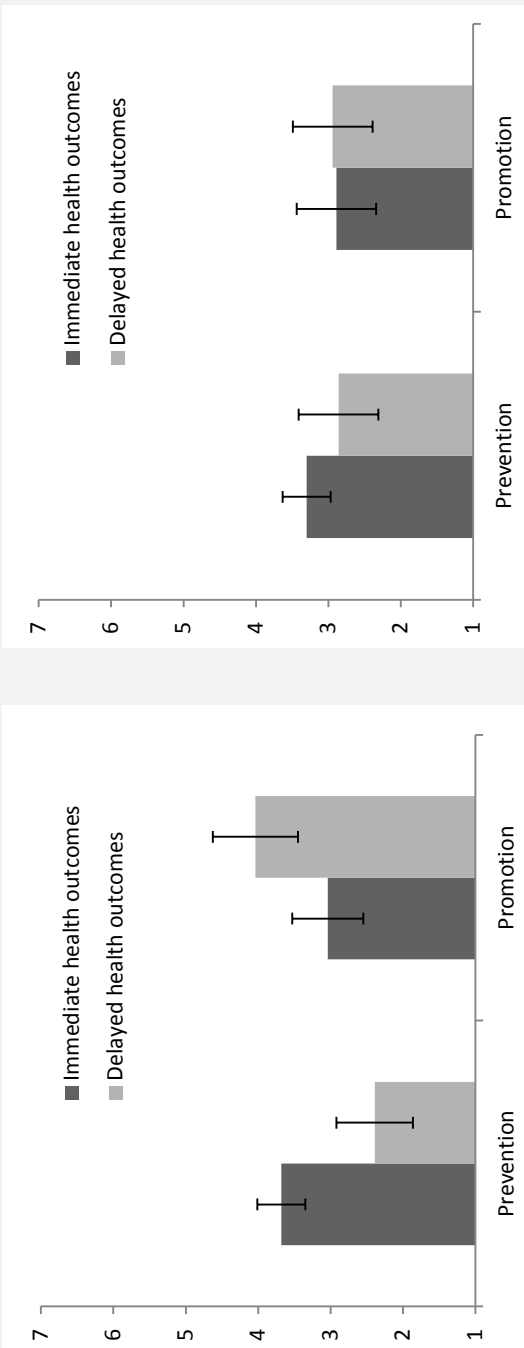


Figure 6.1. Three way interaction between temporal distance, health outcome framing, and regulatory focus (Error bars indicate 95% confidence intervals)

The findings of Study 1, provide sufficient ground to investigate whether the effect of temporal distance, health outcome framing, and regulatory focus on adoption intention is mediated by individuals' perceptions of privacy risk and personalisation benefit. Study 2, therefore, aims to replicate the results of Study 1, and in addition extends the research framework with privacy risk and personalisation benefit perceptions as mediators.

6.5. Methods Study 2

Apart from two minor differences, Study 2 was identical to Study 1. The first difference was that the adoption intention items were followed by measures of perceived personalisation benefit and perceived privacy risk (for items see Chapter 4, Table 4.2). The second difference was that Study 2 did not contain the initial part on an unrelated topic. Participants were 242 students between 16 and 31 years ($M=20.8$, $SD=1.72$), of whom 27.7% was male. Data were collected late spring 2015.

Mediation effects were tested using PROCESS for SPSS (Hayes, 2013) with a bias-corrected bootstrap estimation approach of 1000 and a 95% confidence interval.

6.6. Results Study 2

6.6.1. Adoption intention

A factorial ANOVA where adoption intention was predicted by temporal distance, health outcome framing, and regulatory focus showed a significant main effect of health outcome framing. Adoption intention was higher for the prevent illness frame ($M=3.74$, $SE=.15$) than for the promote health frame ($M=3.25$, $SE=.14$), ($F(1, 234)=5.63$, $p=.019$, partial $\eta^2=.02$). There was no main effect of regulatory focus ($F(1, 234)=.18$, $p=.67$) or temporal distance ($F(1, 234)=2.45$, $p=.12$) on adoption intention.

Replicating Study 1, there was a significant interaction effect of regulatory focus and temporal distance on adoption intention ($F(1, 234)=4.24$, $p=.041$, partial $\eta^2=.02$) (Figure 6.2). Simple effects analysis confirmed the effects found in Study 1. For prevention-focused participants adoption intention was higher when health outcomes were immediate ($M=3.83$, $SE=.21$) instead of delayed ($M=3.08$, $SE=.19$), ($F(1, 234)=6.70$, $p=.010$). The effect of temporal distance on adoption intention was not significant for promotion-focused participants ($F(1, 234)=.119$, $p=.731$). None of the other 2- or 3-ways interactions were significant.

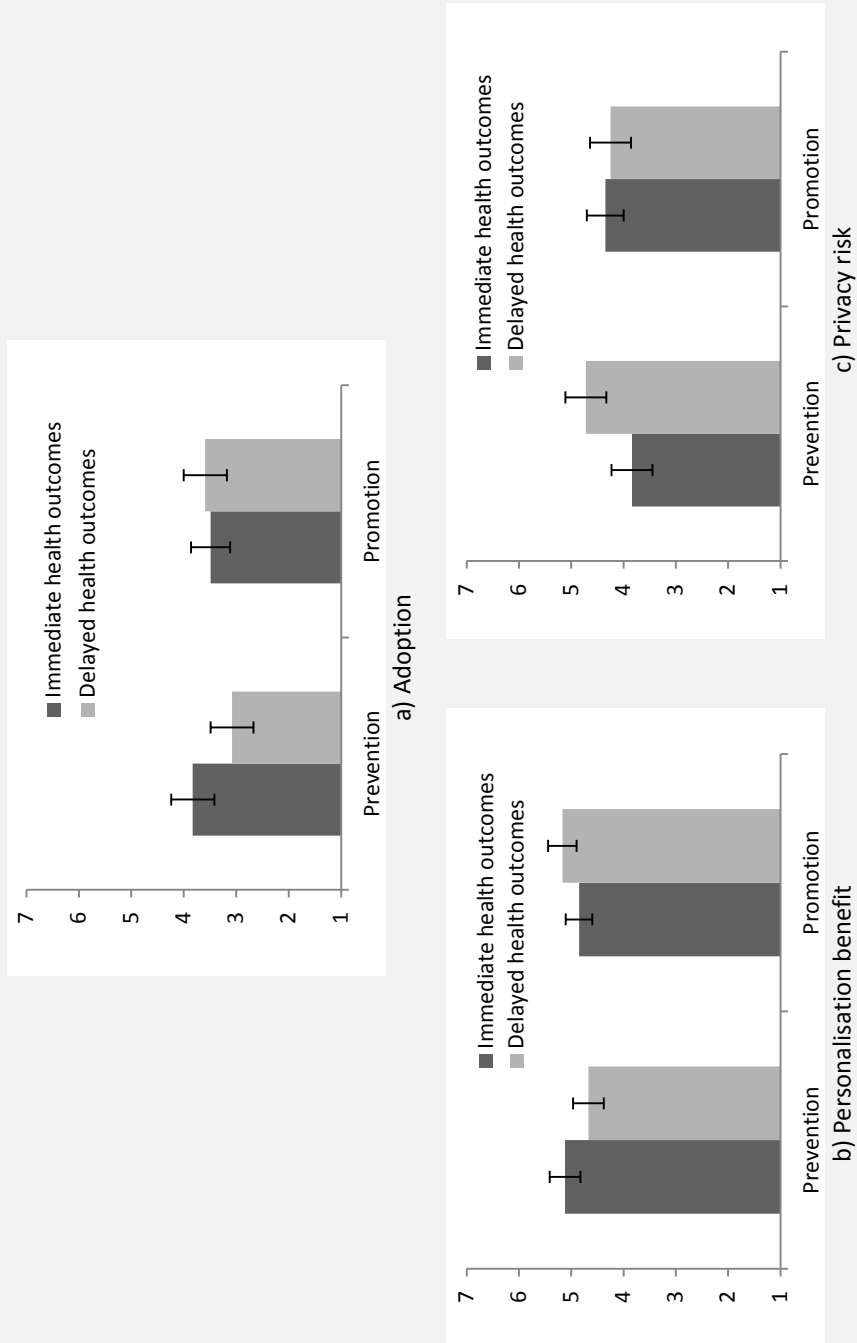


Figure 6.2. Interaction between regulatory focus and temporal distance for adoption intention, personalisation benefit, and privacy risk (Error bars indicate 95% confidence intervals)

6.6.2. Personalisation benefit

A factorial ANOVA where perceived personalisation benefit was predicted by temporal distance, health outcome framing, and regulatory focus showed a significant main effect of health outcome framing. Benefit perception was higher for the prevent illness frame ($M=5.10$, $SE=.10$) than for the promote health frame ($M=4.80$, $SE=.10$), ($F(1, 234)=4.40$, $p=.037$, partial $\eta^2=.02$). There was no main effect of regulatory focus ($F(1, 234)=.61$, $p=.44$) or temporal distance ($F(1, 234)=.23$, $p=.63$) on perceived personalisation benefit.

There was a significant interaction effect of regulatory focus and temporal distance on perceived personalisation benefit ($F(1, 234)=7.39$, $p=.007$, partial $\eta^2=.03$). Simple effects analyses showed that prevention-focused participants had a higher perception of personalisation benefit when health outcomes were immediate ($M=5.12$, $SE=.15$) instead of delayed ($M=4.67$, $SE=.13$), ($F(1, 234)=5.21$, $p=.023$). The effect of temporal distance on perceived personalisation benefit was not significant for promotion-focused participants ($F(1, 234)=2.46$, $p=.118$). None of the other 2- or 3-ways interactions were significant.

6.6.3. Privacy risk

A factorial ANOVA where perceived privacy risk was predicted by temporal distance, health outcome framing, and regulatory focus showed a significant main effect of temporal distance. Risk perception was lower when health outcomes were immediate ($M=4.10$, $SE=.14$) instead of delayed ($M=4.48$, $SE=.13$), ($F(1, 234)=4.07$, $p=.045$, partial $\eta^2=.02$). There was no main effect of regulatory focus ($F(1, 234)=.01$, $p=.91$) or health outcome framing ($F(1, 234)=.00$, $p=.97$) on perceived privacy risk.

There was a significant interaction effect of regulatory focus and temporal distance on perceived privacy risk ($F(1, 234)=6.62$, $p=.011$, partial $\eta^2=.03$). Simple effects analyses showed that prevention-focused participants had a lower perception of privacy risk when health outcomes were immediate ($M=3.84$, $SE=.20$) instead of delayed ($M=4.72$, $SE=.18$), ($F(1, 234)=10.74$, $p=.001$, partial $\eta^2=.04$). The effect of temporal distance on perceived privacy risk was not significant for promotion-focused participants ($F(1, 234)=0.15$, $p=.697$). None of the other 2- or 3-ways interactions were significant.

6.6.4. Mediation analysis

A mediation analysis was conducted to investigate whether the main effect of health outcome framing on adoption intention and the interaction effect of regulatory focus and temporal distance on adoption intention were mediated by perceptions of privacy risk

and/or personalisation benefit. Adoption intention ($R^2=.26$) was predicted by perceived personalisation benefit ($b=.71$, $t=8.97$, $p<.001$), but not by perceived privacy risk ($b=-.09$, $t=-1.51$, $p=.13$). The effect of health outcome framing on adoption intention was fully mediated by perceived personalisation benefit. The indirect effect of health outcome framing on adoption intention was $-.11$ (95% CI $[-.22, .03]$), with a moderate effect size of $\kappa^2=.08$ (95% CI $[.02, .14]$). The non-significant direct effect of health outcome framing on adoption intention was $-.14$, $p=.13$. The interaction effect of regulatory focus and temporal distance on adoption intention was also fully mediated by perceived personalisation benefit. The indirect effect of the interaction effect of regulatory focus and temporal distance on adoption intention was $.15$ (95% CI $[.06, .15]$), with a moderate effect size of $\kappa^2=.10$ (95% CI $[.04, .17]$). The non-significant direct effect of health outcome framing on adoption intention was $.09$, $p=.33$.

6.7. Discussion Study 2

Study 2 shows that the interaction between regulatory focus and temporal distance determines not only adoption intention, but also perceived personalisation benefit and perceived privacy risk, which replicates and extends the results of Study 1. In contrast to Study 1, health outcome framing did not moderate the interaction between regulatory focus and temporal distance.

Temporal distance had an significant effect on perceived privacy risk but not on perceived personalisation benefit, which provides partial support for our expectations. However, rather than decrease over time, perceptions of privacy risk were greater when temporal distance was high. This finding may have occurred due to the fact that privacy risk perceptions depend of the extent to which individuals feel in control over their personal information (Phelps et al., 2000), and information control is likely to decrease as time passes. Against expectation, perceptions of privacy risk were not a mediator.

6.8. General discussion

Using personalised nutrition as a case, this study provides insight into how the interplay between temporal distance and regulatory focus affects individuals' intention to adopt nutritional recommendations. Two experiments confirmed that adoption intention is determined by the interaction between regulatory focus and temporal distance. In line with our expectations, individuals who strived for safety and security (i.e. prevention focus) preferred to adopt nutritional recommendations that offer immediate rather than delayed health outcomes. The adoption intention of individuals who strived for accomplishment

and advancement (i.e. promotion focus) did, however, not differ depending on whether health outcomes were immediate or delayed.

The cognitive process through which the interaction between regulatory focus and temporal distance affects individuals' intention to adopt nutritional recommendations was mediated through perceived personalisation benefit. Prevention focussed individuals had higher perceptions of personalisation benefit when nutritional recommendations offered immediate rather than delayed health outcomes. In the case of promotion focused individuals temporal distance did not have an effect on perceived personalisation benefit. These results are consistent with prior findings, which identified perceived personalisation benefit as the main determinant of adoption intention (Berezowska et al., 2015) (Chapter 4). Furthermore, the results align with the finding that the motivation that drives behaviour moderates the relationship between perceived personalisation benefit and its antecedents (Chapter 5). The current study extends this finding by demonstrating that not only the reason why individuals are motivated to engage in health behaviour but also what they want to achieve through it affect individuals' perceptions of personalisation benefit.

The interaction between regulatory focus and temporal distance influenced perceptions of privacy risk. Prevention focused individuals had lower perceptions of privacy risk when nutritional recommendations offered immediate rather than delayed health outcomes. In the case of promotion focused individuals temporal distance did not have an effect on perceived privacy risk. Perceived privacy risk itself did, however, not affect individuals' adoption intention. Hence, in contrast to perceived personalisation benefit, perceived privacy risk did not mediate the cognitive process through which the interaction between regulatory focus and temporal distance affects adoption intention.

To create a research setting that closely fits real world encounters, the stimulus material mainly highlighted the positive health outcomes of personalised nutrition, which may explain why perceived privacy risk did not contribute to adoption intention. Considering that individuals often ignore privacy risks when benefits are present (Belanger & Crossler, 2011; Pavlou, 2011; Smith et al., 2011), the salience of the positive health outcomes may have downplayed the importance of privacy risk. In the light of this limitation, it must be said that although the findings of this study show no evidence that perceptions of privacy risk are relevant for the adoption of nutritional recommendations, it is not advisable to fully dismiss perceptions of privacy risk. When benefits are less prominent, it may be that perceived privacy risks will affect the adoption of personalised nutritional recommendations. Especially since risks and benefits are related through the affect heuristic, which predicts that a decrease in benefit perceptions induces an increase in risk perceptions, and vice versa (Finucane et al., 2000). Hence, even if there is no direct effect of privacy risk on adoption intention, perceived privacy risks may still affect adoption intention through the perceptions of personalisation benefit.

The finding that promotion focused individuals were insensitive to temporal distance could be further understood drawing on the construal level theory (Trope & Liberman, 2010). Construal level theory proposes that individuals reason about objects and events from the perspective of either a low (i.e. emphasis on details) or high (i.e. emphasis on the bigger picture) construal level. Compared to low construal, individuals who reason from a high construal mind set are more likely to engage in global information processing (J. Forster & Higgins, 2005) that revolves around the desirability of behavioural outcomes (Sagristano, Trope, & Liberman, 2002). Since a promotion focus is associated with high construal reasoning (A. Y. Lee, Keller, & Sternthal, 2010), it is likely that promotion focused individuals paid attention to whether the adoption of nutritional recommendations will result in positive health outcomes at all rather than when the health outcomes will occur. Future research should validate this explanation by showing that high construal reasoning leads to similar outcomes as promotion focused regulatory orientations.

The present findings suggest that to maximise the adoption of nutritional recommendations it is particularly important to account for the time preference of prevention focused individuals. Since prevention focused individuals prefer immediate health outcomes and there is no evidence that promotion focused individuals are sensitive to temporal distance, time preference can be nullified if individuals with a prevention focus can be placed in a promotion focused state. Inducing a change in regulatory orientation could, however, be impractical in a real-life setting. It may, therefore, be more feasible to shift the positive health effects of nutritional recommendations from the future to the present. As most positive effects of nutritional recommendations materialise over a longer period of time (e.g. prevention of chronic diseases), shifting health outcomes from the future to the present poses a challenge. This challenge could be overcome if delayed health outcomes are made more tangible by direct feedback regarding individuals' progress on long-term health improvement or maintenance that can be provided through wearable devices which monitor relevant biomarkers. Further research is required to determine whether direct feedback with regard to long-term health goals is an acceptable and effective way to shift future health benefit into the present.


Similar to other studies (Latimer et al., 2008; Martinez, Duncan, Rivers, Latimer, & Salovey, 2013; Pfeffer, 2013), this study did not find support for the regulatory fit hypothesis, which predicts an increase in adoption intention when the framing of a health message matches individuals' regulatory orientations (Higgins, 2000). The results of Study 1 did show that the interaction between regulatory focus and temporal distance is affected by framing. Prevention-focused individuals preferred immediate and promotion-focused individuals preferred delayed health outcomes, but only when the health outcomes were framed as illness prevention, and not health promotion. Although these results suggest that health promotion frames allow to align temporal distance with regulatory focus, the results of Study 2 do not support this suggestion and instead show that health promotion frames reduce both benefits perceptions and adoption intention. Hence, further research is

needed to determine the exact effect of framing in the context of nutritional recommendations.

Overall, due to the sample's relative homogeneity in term of age and education level (i.e. student sample), some caution with regard to our research findings is warranted. For instance, prior research shows that young adults are more inclined to disclose personal information (Nosko, Wood, & Molema, 2010), and consequently may be less sensitive to potential privacy risks. Furthermore, when thinking about the future adolescents are mainly concerned with relatively short term outcomes related to education and career (Nurmi, 1991), which might have downplayed the importance of future health outcomes. Considering the potential limitations resulting from the use of a student sample, we recommend future research to confirm the present findings with a more representative sample. Regardless of this limitation, the current study shows that tailoring temporal distance to individuals' regulatory focus can be used to stimulate health behaviour.

6.9. Conclusion

This study advances health-related theory by showing how the motivation that drives individuals' health goals affects their preference for short or long term health outcomes. Individuals who want to avoid disease prefer short term health outcomes, while for individuals who want to optimise health the timing of health outcomes seems irrelevant. From a practical point of view these findings imply that to stimulate the adoption of health behaviours, health interventions should be designed in a way that places their health effects as close in time as possible.





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Appendix 6.1. Lay-out of the personalised nutrition service flyers

General discussion

To better understand individuals' intention to adopt personalised nutrition advice, this thesis provides insight into factors that contribute to the trade-off between perceived privacy risk and perceived personalisation benefit. To do so, the effect of service design and self-regulation was studied, as well as the underlying cognitive process that leads to the adoption of personalised nutrition advice. To investigate the effect of these factors on the risk-benefit trade-off, three research questions were addressed: 1) *How does service design affect the risk-benefit trade-off?*; 2) *What is the cognitive process behind the risk-benefit trade-off?*; 3) *How is the cognitive process that drives the risk-benefit trade-off affected by self-regulation?* This final chapter provides the answer to each of the research questions, and integrates these answers into overall implications at a theoretical and applied level. Furthermore, limitations of the conducted research and suggestions for future studies are discussed.

7.1. Service design and the risk-benefit trade-off

To identify how service design affects the risk-benefit trade-off, first an overview of personalised nutrition services currently available in the market place together with a classification of these services based on their defining attributes was provided in Chapter 2. The main differences between the identified services were related to service providers, the employed communication channels, advice scope, and advice frequency. The personal information on which the nutrition advice was based was similar across services. Most services required lifestyle and/or phenotypic information. Services that used genotypic information were rare. Although outside the scope of Chapter 2, the reason why most personalised nutrition services required lifestyle and/or phenotypic information rather than genotypic information may be twofold. First, considering that the technology behind genotype-based personalised nutrition has not fully matured (Wang, 2014) may prevent providers of personalised nutrition services from looking beyond lifestyle and phenotypic information. Second, it may be that a low demand for genotype-based nutrition advice makes it hard to develop a business model that sustains this type of personalised nutrition advice. Pioneers in the field of genotype-based personalised nutrition such as Sciona (Saukko, 2013) lacking market success suggests that the second option is highly plausible. Understanding the demand for genotype-based personalised nutrition was, therefore, key to the remaining part of this dissertation.

Through a privacy calculus lens (Culnan & Armstrong, 1999), a concept from the Information Science and Systems literature which implies that to gain personalisation benefits privacy risks have to be accepted, the effect of service design on the risk-benefit trade-off was investigated in Chapters 3 and 4. Compared to lifestyle and phenotypic information, when a personalised nutrition service required genotypic information perception of privacy risk increased while perceptions of personalisation benefit remained unchanged. This finding is likely to explain the low demand for genotype-based

personalised nutrition advice and with that the low occurrence of services that provide such advice. Furthermore, services that allowed for face-to-face communication enjoyed lower perceptions of privacy risk and higher perceptions of personalisation benefit. Considering that most services that provide genotype-based personalised nutrition advice operate by means of online communication (Chapter 2), the lack of face-to-face communication may be another explanation for the low demand for genotype-based personalised nutrition advice. In terms of advice scope and advice frequency, perceptions of personalisation benefit increased when a personalised nutrition service offered follow-up and combined advice on nutrition with advice on physical activity. The importance of physical activity for individuals' perceptions of personalisation benefit is supported by recent research, which suggests that regular physical activity facilitates healthy eating (Fleig, Kerschreiter, Schwarzer, Pomp, & Lippke, 2014). To make sure that individuals engage in regular physical activity follow-up is key, as it stimulates adherence (Bosworth, 2010).

7.2. Cognitive process and the risk-benefit trade-off

To understand the mechanism through which the design of personalised nutrition services affects the adoption of personalised nutrition advice, the cognitive process behind the risk-benefit trade-off was explored in Chapter 3 and quantified in Chapter 4. Within the trade-off between perceived privacy risk and perceived personalisation benefit, benefits weighed heavier than risks. This finding is in line with research from the Information Science and Systems literature (e.g. Morosan & DeFranco, 2015; Sun, Wang, Shen, & Zhang, 2015; Heng Xu et al., 2011; Heng Xu et al., 2009), which implies that the dominant role of perceived personalisation benefit can be generalised across domains (e.g. commerce vs. health) that revolve around different types of personal information. In addition, our findings identify factors that determine perceptions of privacy risk and personalisation benefit in the health domain. Consistent with the Information Science and Systems literature, perceptions of privacy risk were determined by the extent to which individuals perceived to have control over the disclosed personal information (Cheung, Lee, & Chan, 2015; Krasnova, Spiekermann, Koroleva, & Hildebrand, 2010; H. Li et al., 2014) and the extent to which they perceived the disclosed personal information to be intrusive (Dinev et al., 2013; Kehr et al., 2015). As expected, perceived privacy risk decreased as information control increased and information intrusiveness decreased. Perceptions of personalisation benefit also depended on perceived information intrusiveness, and in addition on the extent to which individuals believed the service to be effective. In line with our expectations, perceptions of personalisation benefit increased with both increasing levels of service effectiveness and information intrusiveness. Since drivers of perceived personalisation benefit are rarely studied in the Information Science and Systems and the health domain, this thesis provides an initial indication of possible determinants.

Perceived service effectiveness and perceived information control were determined by different trust dimensions. Most studies that investigate the effect of trust on the trade-off between perceived privacy risk and perceived personalisation benefit define trust as a single construct that consists of multiple dimensions (e.g. Dinev et al., 2006; H. Li et al., 2014; Morosan & DeFranco, 2015). This dissertation investigated the contribution of each trust dimension to the risk-benefit trade-off separately. We show that the perceived reliability of a service provider is a relevant predictor of information control, while the perceived competence of a service provider is a relevant predictor of service effectiveness. More specifically, the more reliable a service provider seemed to be the more control individuals perceived to have over the disclosed personal information, which reduced perceptions of privacy risk. In terms of competence, service providers that induced high perception of competence increased the extent to which a personalised nutrition service was perceived as effective, which in turn amplified individuals' perceptions of personalisation benefit.

7.3. Self-regulation and the risk-benefit trade-off

The effect of self-regulatory motivation on the risk-benefit trade-off was investigated in Chapter 5 by studying the extent to which individuals' motivation to eat healthily affects the cognitive process that leads to the adoption of personalised nutrition advice. Differences in individuals' motivation to eat healthily moderated the relations within the cognitive process. The strength of the relations differed depending on whether individuals ate healthily by volition (i.e. autonomous motivation) or because they felt forced to do so (i.e. controlled motivation). High levels of autonomous motivation strengthened relations that concerned perceived personalisation benefit and weakened relations that concerned perceived privacy risk. The opposite was true for high levels of controlled motivation. Hence, although overall relations that concern perceived personalisation benefit weigh heavier than relations that concern perceived privacy risk, autonomous individuals tend to pay more attention to personalisation benefit, while controlled individuals tend to pay more attention to privacy risk. Concerning the moderating role of autonomous and controlled motivation, this dissertation adds to existing research (e.g. Lange, Corbett, Lippke, Knoll, & Schwarzer, 2015; Marcinko, 2015; Neighbors et al., 2003) by studying the effect of motivation in the context of causal paths (i.e. sequential causal effects) rather than relations between one dependent and one independent variable (i.e. single causal effect). Investigating the effect of motivation on sequential causal effects was relevant, as single causal effects do not allow to identify how motivation affects cognitive processes such as the one that drives the adoption of personalised nutrition advice. Furthermore, we contribute to existing knowledge by confirming the assumption (e.g. Brunet et al., 2015) that autonomous motivation is linked to benefit perceptions, while controlled motivation is linked to risk perceptions.

The link between self-regulatory motivation and the risk-benefit trade-off was further illustrated in Chapter 6, which explored how individuals' motivation to either prevent negative (i.e. prevention focus) or promote positive (i.e. promotion focus) outcomes affects perceived privacy risk and perceived personalisation benefit. Individuals' regulatory focus did not directly affect perceptions of privacy risk and personalisation benefit. Both perceived privacy risk and perceived personalisation benefit were, however, affected by the interaction between an individual's regulatory focus and the timing of health outcomes. Prevention focused individuals had lower perceptions of privacy risk and higher perceptions of personalisation benefit when health outcomes were immediate rather than delayed. In the case of promotion focused individuals, offering immediate or delayed health outcomes had no effect on perceptions of privacy risk or perceptions of personalisation benefit. So far it was assumed that risk perceptions decrease and benefit perceptions increase as behavioural outcomes lie further in the future (Eyal et al., 2004). Our findings, however, suggest that this assumption does not hold for individuals with a prevention focus, which provides a complementary view regarding the effect of temporal distance on individuals' risk and benefit perceptions.

7.4. Theoretical implications

This dissertation looked at individuals' intention to adopt personalised nutrition advice from the perspective of the privacy calculus. By doing so, it extends the privacy calculus concept in two ways. First, it showed that the privacy calculus, which originates from Information Science and System studies related to e-commerce (e.g. Dinev et al., 2006; H. Li et al., 2010; Heng Xu et al., 2009) and social media (e.g. Dinev et al., 2013; Krasnova et al., 2010; F. Xu, Michael, & Chen, 2013), is also relevant for the understanding of individuals' intention to adopt health services. Second, while most studies do not include an explicit privacy calculus construct when investigating the trade-off between privacy risks and personalisation benefits (e.g. Keith et al., 2013; Sun et al., 2015; Heng Xu et al., 2009), this dissertation shows that an explicit privacy calculus construct complements the conceptual framework of the privacy calculus. Future studies may, therefore, consider to include such construct when investigating the trade-off between privacy risks and personalisation benefits.

Compared to other studies that investigated the effect of perceived risk and perceived benefit on individuals' intention to adopt personalised nutrition advice (e.g. Póinhos et al., 2014; Ronteltap et al., 2009), this dissertation aligns with the observation that benefit perceptions weigh substantially heavier than risk perceptions. The fact that our findings align with prior studies is not self-evident, as in contrast to prior studies we investigated adoption intention in relation to personalised nutrition as an object (i.e. specific service) rather than a concept (i.e. general idea). Showing that the way in which personalised nutrition is presented does not affect the weighing of risks and benefits is a relevant

insight, as presenting personalised nutrition as either a concept or an object addresses different construal levels (Trope & Liberman, 2010), which are likely to influence the importance of risk perceptions (e.g. Eyal et al., 2004; Lerner, Streicher, Sachs, Raue, & Frey, 2015). The observation that benefits remain the strongest determinant of adoption intention regardless of a possible difference in addressed construal level, therefore, strengthens the notion that perceived benefits are central to the adoption of personalised nutrition advice. Also, in contrast to prior studies into the adoption of personalised nutrition advice (e.g. Poínhos et al., 2014; Ronteltap et al., 2009), this dissertation used a more specific operationalisation of risk and benefit perceptions. Where prior studies looked at the effect of general risk and benefit perceptions on individuals' intention to adopt personalised nutrition advice, we specifically assessed perceptions of privacy risk and personalisation benefit. Similar to presenting personalised nutrition as either a concept or an object, asking participants to think about general or specific risks and benefits addresses different construal levels, which may modify the effect of risks and benefits on adoption intention. Showing that despite the difference in operationalisation the impact of perceived benefit is greater than that of perceived risk, provides further support for the dominant role of benefit perceptions. It should be noted that instead of privacy risk, risk can also be specified in terms of for instance financial risk or performance risk (M. Lee, 2009). The weight of specific risk perceptions within the risk-benefit trade-off may, therefore, change depending on which type of specific risk is assessed.

In line with prior findings (Poínhos et al., 2014), the cognitive process that leads to the adoption of personalised nutrition advice was highly similar across the eight European countries that participated in this research. The finding that the cognitive process is robust and can most likely be generalised to all European countries suggests that segmenting the European population based on country borders is not the most relevant way to increase our understanding of individuals' intention to adopt personalised nutrition. By looking at how two types of self-regulatory motivation (i.e. self-determination and regulatory focus) affect the cognitive process, this dissertation explored the effect of psychographic differences on the adoption of personalised nutrition within Europe. The fact that self-regulatory motivation had an effect on the cognitive process suggests that to increase our understanding of individuals' intention to adopt personalised nutrition advice it is indeed more useful to segment the European population based on individual rather than country level differences. Beyond the scope of this research, we suggest that it may be worthwhile to explore how other psychographic differences related to for instance general privacy concerns (van Doorn & Hoekstra, 2013) and uncertainty avoidance (Krasnova, Veltri, & Gunther, 2012) affect the cognitive process that drive the adoption of personalised nutrition.

In addition to personalised nutrition advice, the risk-benefit trade-off is also relevant for the uptake of food products associated with novel technologies such as genetic modification, irradiation, and nanotechnology (Frewer et al., 2011). Studies into novel food technologies

are inconclusive about whether individuals' intention to adopt products that involve these technologies is more likely to depend on risk or benefit perceptions (Bearth & Siegrist, 2016). This dissertation suggests that including self-regulatory factors, related to for instance autonomous and controlled motivation, as variables that moderate the effect of risk and benefit on adoption intention may shed light on the inconsistent weight of risks and benefits within the food technology domain.

7.5. Practical implications

Studying the trade-off between perceived privacy risk and perceived personalisation benefit in the context of personalised nutrition, provides insights on how to stimulate individuals' intention to adopt personalised nutrition advice. This dissertation shows that individuals' intention to adopt personalised nutrition advice mainly depends on perceptions of personalisation benefit. To maximise perceptions of personalisation benefit across the larger population, the health outcomes that result from the use of personalised nutrition advice should be placed in the present rather than the future. Ideas on how this may be done are provided by other studies, which describe wearable devices that monitor behaviour and /or relevant biomarkers to provide people with direct feedback on health improvement and health maintenance (Erickson et al., 2014; H. Forster, Walsh, Gibney, Brennan, & Gibney, 2016). Perceptions of personalisation benefit may also be increased through perceived service effectiveness. To increase perceptions of service effectiveness it is important that personalised nutrition advice is provided by competent service providers such as qualified professionals from the field of dietetics. In addition, perceptions of service effectiveness are likely to increase by accounting for service attributes that stimulate advice adherence such as regular face-to-face meetings.

Although the use of genetic information for health purposes such as tailored dietary recommendations has been around for more than a decade (Rafiq, Ianuale, Ricciardi, & Boccia, 2015; Stover, 2004), this dissertation shows that the extent to which individuals know and understand the relevance of genetic information for the formation of meaningful dietary recommendation is limited. In addition, our findings show that personalised nutrition advice that is based on genotypic information significantly increases risk perceptions without enhancing perceptions of benefit. Such effect of genetic information on risk and benefit perceptions suggests that individuals ignore the added value that results from genotype-based personalised nutrition advice. Benefit perceptions can, therefore, not be increased by simply providing highly advanced types of personalised nutrition advice based on genetic information. To be able to use genetic information as an attribute that increases individuals' perceptions of personalisation benefit, the added value of genotype-based personalised nutrition advice needs to be highlighted and clearly communicated. While doing so, it is also worthwhile to decrease perception of privacy risk

by increasing the extent to which individuals have control of their personal information after disclosure.

Provided that individual differences are accounted for, the generalisability of the cognitive process behind the adoption of personalised nutrition advice suggests that once a feasible strategy to induce high benefit and low risk perceptions is developed, it should work equally well across Europe. The success of such strategy will be greatest when individuals adopt personalised nutrition on a voluntary basis, as this dissertation shows that autonomous motivation increases individuals' perceptions of personalisation benefit and decreases perceptions of privacy risk. To stimulate autonomous motivations, it may be worthwhile to allow potential consumers to make their own choices about which health goals they want to pursue and how they want to pursue these health goals (Kusurkar, Croiset, & Ten Cate, 2011). In other words, in the case of personalised nutrition services customisation may be more suitable than personalisation.

7.6. Limitations and future research

A limitation to this dissertation is that the studies were conducted in a hypothetical setting, which may limit their external validity. Hypotheticality was introduced by instructing randomly selected participants to imagine that they would like to engage with a personalised nutrition service and then asking them to evaluate fictitious services. This methodology may have affected the research findings as it created a situation in which evaluating personalised nutrition services might have felt forced and/or unnatural. Such situation may in turn have lowered participants' interest in and motivation to take a closer look at a particular personalised nutrition service and imagining how adopting this service would impact their life (Trope & Liberman, 2010). Future studies may reduce hypotheticality by focusing on individuals who have a strong interest in nutrition advice and providing these individuals with more realistic representations of personalised nutrition services. A possible way to achieve this would be a study in which individuals disclose personal information, engage with a personalised nutrition service, and implement the personalised nutrition advice, so they can truly experience what personalised nutrition means to them.

The generalisability of the findings is limited by the fact that they were obtained based on a sample of the European population. This is particularly true for the finding that within the risk-benefit trade-off perceived personalisation benefit weighed heavier than perceived privacy risk. Whereas in Europe individuals' privacy is protected by laws that prohibit compilation and transfer of personal information, in other countries such as the US these laws are less strict (Levin & Nicholson, 2005). Well-developed data protection legislation may lower individuals' concerns about and perceptions of privacy risk, which in the case of European citizens may have reduced the weight of privacy risk within the risk benefit trade-off. This idea is related to the risk homeostasis theory (Wilde, 1998), which suggests that

the extent to which people are willing to take risk depends, among others, on their past experience with risk taking and the consequences thereof. The greater and the more severe the experienced consequences were, the safer one will want to behave, which may increase the importance of risk within the risk benefit trade-off. As populations that have to deal with less-developed or absent data protection legislation are more likely to experience severe consequences related to data protection, they are also more likely to assign a greater weight to perceived privacy risk. Future research should determine whether the findings of the current dissertation and the inferences that can be drawn based on these findings hold for populations outside Europe.

This dissertation focused on the adoption of personalised nutrition advice. Adoption is, however, merely the first step in making personalised nutrition advice a tool that successfully guides individuals' dietary choices. The extent to which personalised nutrition advice will succeed to guide dietary choices and contribute to public health does not only depend on the extent to which individuals are willing to adopt such advice, but also on the extent to which individuals are willing and able to adhere to the provided advice. For personalised nutrition advice to live up to its full potential it is recommended that future research focusses on factors that stimulate compliance with dietary recommendations. One of such factors may be direct feedback. Complying with dietary recommendations, and especially preventive dietary recommendations, is hard because the health effects of these recommendations materialise over a longer period of time. Delayed health effects may, however, not provide the necessary positive feedback to encourage individuals to continue complying to the provided dietary recommendations. Making long-term health effects more tangible by for instance providing regular and direct feedback on goal progress may help to create such positive reinforcement. A suitable way to provide feedback on goal progress is offered by e-health applications such as wearable devices and apps. How to best combine e-health and personalised nutrition advice requires further research.

7.7. Conclusion

Adoption of personalised nutrition advice depends mainly on individuals' benefit perceptions with perceived service effectiveness as the key determinant. Furthermore, to better understand the cognitive process that drives individuals' intention to adopt personalised nutrition advice, it is more relevant to segment the European population based on psychometrics than nationality. Finally, for the time being it seems sufficient to provide personalised nutrition advice that is based on lifestyle and phenotypic information.

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Summary

To prevent disease and optimise health, nutrition advice is personalised based on an individuals' lifestyle, health status and/or genetics. Although due to its high degree of personal relevance personalised nutrition advice is highly beneficial, the adoption of such advice may be hindered by the fact that it requires disclosure of personal and sensitive health information which induces the potential risk of privacy loss. This thesis investigates individuals' intention to adopt personalised nutrition advice from the perspective of a trade-off between perceived privacy risk and perceived personalisation benefit. To understand this trade-off knowledge regarding factors that affect individuals' perceptions of privacy risk and personalisation benefit is key. This thesis studies such factors by addressing three research lines: 1) How does service design affect the risk-benefit trade-off?; 2) What is the cognitive process behind the risk-benefit trade-off?; 3) How is the cognitive process that drives the risk-benefit trade-off affected by self-regulation?

An overview of personalised nutrition services currently available in the market place shows that the design of personalised nutrition services mainly differs in terms of service providers, the used communication channels, advice scope, and advice frequency (Chapter 2). The required personal information hardly differs between services, with information related to lifestyle and health status being most common. When compared to lifestyle and health status, perceptions of privacy risk increase when a personalised nutrition service requires genotypic information (Chapters 3 and 4). Disclosure of genotypic information does, however, not increase perceptions of personalisation benefit. Furthermore, perceptions of personalisation benefit increase and perceptions of privacy risk decrease when a personalised nutrition service allows for face-to-face communication. In addition, perceptions of personalisation benefit increase when services provide regular follow-up and combined dietary advice with physical activity.

The cognitive process is driven by the trustworthiness and competence of service providers (Chapters 3 and 4). The more trustworthy a service provider seems to be the more control individuals perceive to have over the disclosed personal information, which reduces perceptions of privacy risk. In terms of competence, service providers that induce high perception of competence increase the extent to which a personalised nutrition service is perceived as effective, which in turn amplifies individuals' perceptions of personalisation benefit. Within the trade-off between perceived privacy risk and perceived personalisation benefit, benefits weigh heavier than risks independent of individuals' nationality.

Whether individuals eat healthily by volition (i.e. autonomous motivation) or because they feel forced to do so (i.e. controlled motivation) affects the extent to which perceived privacy risk, perceived personalisation benefit, and their determinants predict adoption intention (Chapter 5). Within this cognitive process, high levels of autonomous motivation

strengthen relations related to perceived personalisation benefit and weaken relations related to perceived privacy risk. In contrast to autonomous motivation, high levels of controlled motivation strengthen relations related to perceived privacy risk and weaken relations related to perceived personalisation benefit. Autonomous individuals therefore seem to pay more attention to personalisation benefit, while controlled individuals seem to pay more attention to privacy risk. The trustworthiness of a service provider is relevant to all, regardless the level of autonomous or controlled motivation.

Individual's motivation to either prevent negative outcomes (i.e. prevention focus) or promote positive outcomes (i.e. promotion focus), called regulatory focus also affects perceptions of privacy risk and personalisation benefit (Chapter 6). The effect of the different regulatory foci on perceptions of privacy risk and personalisation benefit occurs through the interaction between an individual's regulatory focus and the timing of health outcomes. Individuals focused on prevention have lower perceptions of privacy risk and higher perceptions of personalisation benefit when health outcomes are immediate rather than delayed. In the case of individuals with a promotion focus offering immediate or delayed health outcomes does not affect perceptions of privacy risk or perceptions of personalisation benefit.

Overall, this thesis shows that individuals' intention to adopt personalised nutrition advice mainly depends on perceptions of personalisation benefit, which are largely determined by one's confidence in the effectiveness of the personalised nutrition service. Individual differences related to motivations do, however, affect the extent to which perceived personalisation benefit determines adoption intention.

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Aleksandra

About the author

Personal profile

Aleksandra Berezowska was born in Oleśnica (Poland) on February 18th, 1985. In 2009, she received her master's degree (Cum Laude) at Twente University, specialising in both Health and Consumer Behaviour Psychology. During her studies she also completed a minor in International Management.

In 2011, Aleksandra started her PhD at the Marketing and Consumer Behaviour group of Wageningen University. She was involved in the Food4Me project, which studied the feasibility of personalised nutrition across the EU. Within this large project, Aleksandra focused on the effect of the risk-benefit trade-off and its determinants on consumer adoption of personalised nutrition services. During her PhD she attended courses on advanced research methods, presented her work at international conferences, and published several papers.

Currently, Aleksandra is a researcher at the Antoni van Leeuwenhoek, where she studies the effect of a care coordination programme on patient wellbeing. Furthermore, she is also employed at Karakter, where she is involved in research on the effect of EMDR therapy on youngsters diagnosed with autism.

Publications

Berezowska, A., Fischer, A. R. H., Ronteltap, A., Kuznesof, S., Macready, A., Fallaize, R., & van Trijp, H. C. M. 2014. Understanding consumer evaluations of personalised nutrition services in terms of the privacy calculus: a qualitative study. *Public Health Genomics*, 17(3); 127-140.

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Aleksandra Berezowska
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan



Name of the activity	Department/Institute	Year	ECTS*
A) Project related competences			
Focus Group Training	Ulster University	2011	1
Research Methodology: from topic to proposal	WASS	2011	4
PhD research proposal	MCB	2012	4
<i>'Consumer perceptions of archetypical personalised nutrition services'</i>	NuGo week, Helsinki	2012	1
<i>'Understanding consumer adoption of personalised nutrition'</i>	WASS PhD day	2013	1
<i>'Understanding consumer adoption of personalised nutrition: a qualitative study'</i>	EHPS, Bordeaux	2013	1
<i>'Personalised nutrition services: a consumer perspective'</i>	Food4Me conference, Brussels	2015	1
B) General research related competences			
Introduction course	WASS	2011	1
Voice and presentation training	WASS	2011	0.5
Scientific writing	WGS	2013	1.8
Qualitative data analysis: procedures and strategies (YRM 60806)	WUR	2011	3
Quantitative data analysis: multivariate techniques (YRM 60306)	WUR	2012	2
Media training	EUFIC	2013	1
Philosophy and Ethics of Food science and Technology	VLG	2013	1.5
PhD lunch colloquia series	MCB	2011-2014	3.5
Research Methodology in Marketing and Management	EIASM, Brussels	2014	4
C) Career related competences/personal development			
Supervising master thesis projects	MCB	2012-2013	1
Teaching assistant: Sensory perception and consumer preference	MCB	2013-2015	2
Teaching assistant: Analysis and management of sustainable organic production chains	MCB	2012-2015	1
Competence Assessment	WGS	2011	0.3
Career perspective	WGS	2013	1.6
Total			37.2
*One credit according to ECTS is on average equivalent to 28 hours of study load			

Abbreviations:

EHPS = European Health Psychology Society
 EIASM = European Institute for Advanced Studies in Management
 EUFIC = European Food Information Council
 MCB = Marketing and Consumer Behaviour
 NuGo = Nutrigenomics Association

WGS = Wageningen Graduate School
 VLAG = Advanced studies in Food Technology, Agrobiotechnology, Nutrition and Health Sciences
 WASS = Wageningen School of Social Sciences
 WUR = Wageningen University and Research Centre

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