COMMENTARY

Nutrigenomics-based personalised nutritional advice: in search of a business model?

Amber Ronteltap · Hans van Trijp ·
Aleksandra Berezowska · Jo Goossens

Abstract 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 in the direction of 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. The present paper takes an inventory of approaches to personalised nutrition currently available in the market place as its 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. It 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 a part of the business model. Future research should explore 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.

Keywords Personalised nutrition · Business models · Consumer · Value creation

Introduction

Recent developments in nutrigenomics hold the potential to revolutionise our understanding of the complex nutrition–health relationships (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 nutritional 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

A. Ronteltap (✉)
LEI, Part of Wageningen University and Research Centre,
Hollandseweg 1, 6706 KN Wageningen, The Netherlands
e-mail: amber.ronteltap@wur.nl

H. van Trijp · A. Berezowska
Marketing and Consumer Behaviour Group, Wageningen
University and Research Centre, Hollandseweg 1,
6706 KN Wageningen, The Netherlands

J. Goossens
Bio-Sense, New Business Development, Elisabethlaan 68,
3200 Aarschot, Belgium

advice (Brug et al. 1999, 2003; Elder et al. 2009; Oenema et al. 2001; Lustria et al. 2009). Such personalisation can take on many forms, including preferred communication channels, socio-demographic differentiation on, for example, income, life stage, and household composition, or phenotype differentiation on, for example, weight, cholesterol level, and 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 nutritional advice can be described as a process with consecutive stages (Vesanen and Raulas 2006). As the first of four stages, the consumer is willing to release 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 customer is willing to incorporate that personalised nutritional 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 customers and suppliers, personalised nutrition advice can add benefits to the value exchange (Van Trijp and 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 and Müller 2004), for example successfully fulfilling the co-design task (Dellaert and Stremersch 2005; Franke and Piller 2004), 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 nutritional advice, Sciona, that has failed to find a viable business model for nutrigenomics-based nutritional advice to commercially survive.

However, for personalised nutritional advice to develop to its full potential, successful commercialisation to consumers is essential (Ronteltap and Van Trijp 2007). Taking a business model approach may shed light on the potential routes to success for personalised nutritional 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 et al. 2011). A business model "describes the rationale of how an organisation creates, delivers, and captures value" (economic, social, or other forms of value) (Osterwalder et al. 2009). A company's business model reflects what its management expect 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—they define 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—they are established and maintained with each customer segment; (5) revenue streams—they result from value propositions successfully offered to customers; (6) key resources—they are the assets required to offer and deliver the previously described elements; (7) key activities—they 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 et al. 2009). 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 data 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 nutritional 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)].

Table 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

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.

Methods

The methodology of 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.

Inventory of personalised nutrition approaches

An inventory of approaches to personalised nutrition currently offered in the market place was conducted through 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 data set 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 1).

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 blocks 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 cases[1] 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.

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 et al. 2009) 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 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.

Extraction of archetypical approaches to personalised nutrition

Rather than seeking for completeness, this task aimed to search for diversity to extract a smaller number of personal 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 were extracted, based on dominant business models that seem to underlie them.

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[1] During the 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.

Table 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 3 Types of personalised offer

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

[a] Cases may offer multiple types of products/services. Therefore, the numbers add up to more than 76

Results

Inventory of personalised nutrition approaches

The Internet search resulted in 76 cases[2] from the following countries: New Zealand, USA, France, Germany, Netherlands, Australia, Belgium, South Africa, Spain, Canada, Ireland, India, and United Kingdom.

Categorisation of personalised nutrition approaches

Tables 2 and 3 show some basic characteristics of the sampled cases, purely for descriptive purposes.[3] 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 mainstream activity in the market of personalised nutrition advice. In terms of targeted market segments (results not shown), the focus within the cases in our data set 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 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, for example 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 data set fall within the price range of 0–100 Euros ($n = 54$); 15 PNOs cost >100 Euros. In the case of follow-up activities (such as 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.

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, in both business-to-business (B2B) and business-to-consumer (B2C) context. 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 et al. 2009) business model canvas (see Table 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 programme to employees. Its key value proposition focuses on a shared responsibility between the employee and its employer for a healthy lifestyle relevant to employee well-being and productivity. Key activity is feedback of lifestyle plan based on individual information and diagnostic data to employees. 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

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[2] Presented in Table 5. The full list of cases, including detailed coding of characteristics, is available from the corresponding author upon request.

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

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 and 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 with a tailored dietary advice. However, the initiative and follow-up are 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.

5. "Step in, step out": This archetypical business model takes the "do-it-yourself-healthy-diets" model one step further to include 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 to the consumer relevant feedback on progress towards health improvement on relevant biomarkers, both non-invasive and invasive phenotypic measures. Key feature is an iterative feedback loop that assures follow-up of the consumer's 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" into two directions. It includes genotypic information next to dietary intake data and phenotypic information as a source of personalised advice and as a monitoring for goal approach. The personalised advice is also broader in scope; it includes other lifestyle changes next to dietary improvement such as activity level or stress/time management. Key feature is the inclusion of genetic information as well.

8. "Face 2 face": This archetypical business model is close to that of traditional dietician's advisory services.

The value proposition is that of personal contact and guidance in face-to-face personalised advice based on dietary intake data. Key feature is the type of customer relationship building, which is an individual real-life situation. Target group 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 a 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 its trustworthiness.

Table 5 presents the 76 cases of our database, categorised by archetypical business model.

There is good representation of all business models, but the number of cases cannot be taken as a measure for success. For example, the "standing strong together" business model is close to that of Weight Watchers; a successful business model rolled out globally. More importantly, the results in Table 5 seem to indicate a high level of activity in the market place to extend beyond the information model to include phenotypic and genotypic information as a business model underpinning personalised nutrition advice.

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 personalisation market offerings 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 customer and the provider of the advice. They all have in

Table 4 Matrix of PNO archetypes and business model elements

	1	2	3	4	5	6	7	8	9
CS	B2B (HRM), medium/large corporations	People who want to change body weight	People who want to 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
VP	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
CH	In-company sessions	Group sessions	Individual & group sessions	Internet (little follow-up options)	Internet (optional: session)	Internet	Internet	Face-to-face sessions	Internet, brochures
CR	1-to-1 partnership with client	Dedicated personal assistance	Dedicated personal assistance	Individual online relation	Individual online relation (optional: personal with dietician)	Individual online relation (high frequency)	Individual online relation (high frequency)	Individual real-life relation	Non-individual (often online)
R$	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	Human (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 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

Table 4 continued

	1	2	3	4	5	6	7	8	9
KP	Diagnostic testing companies, dieticians, software companies	Food producers	–	–	Possibly dieticians	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

common that they work from identified information from the customer (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 dietician). Once the information is received by the supplier, it needs to be translated into a tailored advice, which is communicated back to the customer 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 relationship rather than a one-off, as in many other personalised advice systems.

Not only the public health success, but also the commercial success of personalised nutrition advice depends on enduring relationships with the consumer, which come at a positive revenue versus cost structure. This is essential to the 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" such as current dietary patterns, to become increasingly more invasive and personal, such as 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 would need to focus more in depth on the consumer 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 nutritional advice is still an exception. Our data do not allow us to analyse the underlying causes at the consumer, market, and business levels, 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

Table 5 PNOs, categorised by archetype ($N = 76$)

Archetype	Name PNO	URL
Employee lifestyle guidance	1. Foodplaner	www.foodplaner.de
	2. Institut für Ernährungsinformation	www.ernaehrung.de/software/
	3. Nutrition Quest	www.nutritionquest.com/
	4. Calorie King	www.calorieking.com/
	5. The food calculator	www.thefoodcalculator.com/
	6. Viocare	www.viocare.com
Standing strong together	1. Weight Watchers	www.weightwatchers.nl
Health club	1. Cochin Ayurvedic Center	www.cochinayurvedic.com/index.htm
	2. Tailor made nutrition	www.tailormadenutrition.com
	3. Muscle instructure	www.muscleinstructor.com
	4. X Attack	www.xattack.in/index.php
	5. Smart Training	www.smart-strength-training.com/index.html
Do-it-yourself-healthy-diets	1. Vetvrij.com Dieet voeding gezondheid	www.vetvrij.com
	2. Real (group)	www.real.de/bewussteinkaufen/
	3. Fettrechner	www.fettrechner.de
	4. Diet4u online	www.diet4uonline.com/
	5. Calorie count	www.caloriescount.com/
	6. Fitness tracer	www.shapefit.com/
	7. Stewart Nutrition	www.stewartnutrition.co.uk/
	8. Indiadiets	www.indiadiets.com/index.asp
	9. Sanovide Ayurveda	http://sanovide.com/index.php
	10. "India Parenting Dr Moitra"	www.indiaparenting.com/health/index.shtml
Step in, step out	1. Aujourdhui	www.aujourdhui.com
	2. Le diet	www.lediet.fr/home_lediet.html
	3. Formula for life	www.formulaforlife.com.au/
	4. VHI Diets	www.vhidiets.ie/dietprofile2/home.cfm?code=26031
	5. Fit Day	www.fitday.com
	6. Foodcount.com	www.foodcount.com/index.cfm
	7. Web Dietitian	www.webdietitian.com/new/index.php
	8. Nutrition dairy	www.nutridiary.com
	9. Mickey Mehta	www.mickeymehtahbf.com/
	10. Sportsnutritionist.co.uk	www.sportsnutritionist.co.uk
	11. Live strong.com	www.livestrong.com/
	12. Seasons India	www.seasonsindia.com/healthfitness/mealselect_sea.jsp
	13. India Diet	www.indiadiets.com/Diet_counselling/diet_counseling.htm
	14. Free Deit Calender	www.startyourdiet.com/free_tips.htm
	15. Weit Loss Adviso	www.weight-loss-advisor.com/
Test and run to the finish	1. 1st personal diet-	www.eerstepersoonlijkedieet.nl
	2. Customised online diet (dieticians)	www.a-personaldietitian.com/
	3. Tesco Diets (hosted by ediets.com)	www.tescodiets.ie/
	4. "Duke Health (University and hospital)"	www.dukehealth.org/
	5. Beta Desi Dieter	www.desidieter.com
	6. Healthji	www.healthji.com/community-home.php
	7. Lifecentury	www.lifecentury.com/
	8. Atharv Ayurveda Health Care	www.ayurvedicdietsolutions.com/index.php
	9. Total diet and fitness	www.tailormadehealth.info
	10. Dr. Lam	www.drlam.com
	11. (BiTe) nutrition and lifestyle consultings	www.nutritionbites.com.au/content/view/16/30/
	12. Hellowelness	http://hellowellness.in/Home.aspx

Table 5 continued

Archetype	Name PNO	URL
	13. Healthizen	www.healthizen.com/diet-planner.aspx
	14. Fitho	www.fitho.in/fitho-plans/weight-loss-plans-diet-exercise/
	15. Dr. Weil	www.drweil.com
	16. My diet Planner.com	www.mydietplanr.com/2-how-it-works
	17. Personal Diets	www.a-personaldietitian.com/COD.htm
All-in lifestyle guidance	1. "Genotype Diet/D'Adamo Genetic diet"	www.4yourtype.com
	2. The Apo E Gene diet	perfectgenediet.com/
	3. "Interleukin Genetics inherent health"	www.inherenthealth.com
	4. Metagenics	www.metadocs.com
	5. 23andMe	www.23andme.com
	6. Gene Smart Diagnostics	www.genesmart.com/
	7. DNA analysis	www.dnadiet.co.za/Home.aspx
	8. Vitagenes	www.vitagenes.com
Face 2 face	1. Persoonlijke voedsingspraktijk	www.persoonlijke-voeding.nl
	2. EetBeter	www.eetbeter.com
	3. Ayurvedic Diet Consultation	www.ayurveda-herbs.com/ayurveda-diet.htm
	4. "Tailored nutrition creating foodplans for the individual"	www.tailorednutrition.co.nz
	5. Tailored nutrition	www.tailorednutrition.ca
	6. The tailormade Diet Company	www.tailormadediet.co.uk
	7. Healing with creation	http://healingwithcreation.com
	8. Guided nutrition	www.guidednutrition.com
	9. Fluitcoach en kleurbekennen	www.fluitcoach.nl
	10. Morren	www.dieetzondermorren.be
	11. "Praktijk voor voeding en persoonlijke begeleiding"	www.praktijkvoorvoedingenpersoonlijkebegeleiding.nl
	12. Praktijk Marlie Houben Aben	www.praktijkmarliehouben.nl
We told you so	1. Healthy eating club	www.healthyeatingclub.org/index.htm
	2. Voedingscentrum	www.voedingscentrum.nl

applications (e.g. price, time to do the test, fear of genetics). 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 consumers may be reluctant to make detailed and personal information such as genetic information available for curative purposes, a major public health contribution could come from an application of nutrigenomics-based nutrition advice for 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 a part of a healthy lifestyle (e.g.

sufficient physical activity, 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 in 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 applications 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), nutrigenomics-based nutrition advice business models would need to be explicit about the turnover it generates. 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 nutrigenomics information is personal information, 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 what would be most trustworthy sources, also as a basis for partnerships to commercial partners, to support this crucial step in the process.

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 of 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 in 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 at 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 et al. 2007, 2009), 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.

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