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in new product development: the case of
functional food innovations**

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Abstract

As the majority of new products fail it is important to focus on the needs and preferences of the consumers in new product development. Consumers are increasingly recognised as important co-developers of innovations, often developing new functions for technologies, solving unforeseen problems and demanding innovative solutions. The central research question of the paper is: How to understand consumer needs and preferences in the context of new product development in order to improve the success of emerging innovations, such as functional foods. Important variables appear to be domestication, trust and distance, intermediate agents, user representations and the consumer- and product specific characteristics. Using survey and focus group data, we find that consumers need and prefer easy-to-use new products, transparent and accessible information supply by the producer, independent control of efficacy and safety, and introduction of a quality symbol for functional foods. Intermediate agents are not important in information diffusion. Producers should concentrate on consumers with specific needs, like athletes, women, obese persons, and stressed people. This will support developing products in line with the needs and mode of living of the users.

Key-words: consumer needs, preferences, new product development, functional foods

1. Introduction

The majority of new products fail. A study of Ernst & Young (2000) showed that only one-third of all fast moving consumer goods introduced in Dutch supermarkets in 1998 can be considered successful. New product development is a risky endeavour but is essential for the health and survival of a company (Cooper 1993). The innovation success of new products is improved when there is true added value to the consumer. As Griffin (1996, p.154) already stated: “The most successful product development efforts match a set of fully understood customer problems with a cost-competitive solution to those problems.” It is difficult, however, to understand customer needs and preferences and to balance them with the strategy of producers to make a product that satisfies consumers better than competing alternatives (Schmidt 2005). Often consumers don’t know what new products they demand, since they cannot overlook all future possibilities (Hamel & Prahalad 1994; Griffin 1996). Furthermore, identifying opportunities for new products, especially for radical new, emerging products, is quite difficult, as these products “can offer new, unique, or superior solutions to users’ needs and can create entirely new markets” (Schmidt & Calantone 2006, p. 106). Accordingly, incorporating the ‘voice of the consumer’ in early stages of new product development has been recognised as a critical success factor (Griffin & Hauser 1993; Van Kleef *et al.* 2005).

The traditional economics literature has mostly ignored the relation between research and product development choices of firms and consumer needs and preferences. In innovation studies, research and (product) development is increasingly perceived as a co-evolutionary process, an institutional interplay in which many heterogeneous stakeholders interact in complex ways. The emergence of new functionalities of a product innovation is a particular aspect of the widening process of co-evolution between a new technology and its users. Heterogeneous user groups provide feedback about how a new technology, with a high degree of flexibility regarding product specific characteristics and uncertainty about potential applications and related ethical, legal and social aspects, matches their needs, preferences and performance criteria. These aspects become articulated in demands and interactions between users and producers. Accordingly, users are increasingly recognised as important co-developers of innovations, often developing new functions for technologies, solving unforeseen problems and demanding innovative solutions.

Theoretically, this paper attempts to bridge the gap between the rather classic linear innovation model for understanding new product development, and more recent theorising on innovation systems, characterised by feedback and co-evolution, in which user involvement play an important role.

In order to get more insight in the consumers need and preferences in the context of new product development, this paper focuses on what we can learn from innovation studies about the role of consumers in emerging product innovations. Accordingly, the central research question is: *How to understand consumer needs and preferences in the context of new product development, in order to improve the success of emerging product innovations?* The focus will be on one particular new product development, namely emerging functional food innovations. These new food products are not only intended to originally satisfy hunger, but also to prevent nutrition-related diseases and to increase physical and mental well-being of consumers (Menrad 2003). Therefore, these new products specifically anticipate on consumer needs and preferences.

This study is limited to consumer needs and preferences regarding functional foods innovations in the Netherlands. The reasons for this empirical limitation are two-fold.

Firstly, The Netherlands has a historically and internationally strong position in the food sector, as expressed in the Gross Domestic Product, export and Intellectual Property Rights

(MinEZ 2006). And regarding emerging food technologies, The Netherlands has a relative high technological advantage in nutrigenomics research (Vandeberg & Boon 2008).

Secondly, in 2003, the Dutch Nutrigenomics Consortium has been founded, as a collaboration between the Wageningen Centre for Food Sciences and the Dutch Centre for Medical Systems Biology, with one of its central aims to develop novel food products (Vandeberg *et al.* 2008). Accordingly, the Netherlands has a long tradition in food developments and nowadays a strong position in new food product innovations.

This paper is organised as follows. Section 2 briefly outlines emerging functional foods developments and the various discernable categories of functional foods. To study the needs and preferences of consumers regarding functional food innovations, a conceptualisation of user involvement needs to be made. Section 3 presents such conceptual model for studying consumers needs and preferences with regard to emerging product developments. Section 4 describes the applied research methodology. Surveys and focus group sessions with consumers provided a dataset for analysis. To investigate the presumed relations in the conceptual model, this dataset has been analysed by means of factor analysis (Principal Components Analysis). Section 5 presents the results. Section 6 discusses the findings and ends with conclusions and recommendations.

2. Functional food innovations

Worldwide consumers are becoming more interested in the relation between food and health. In consumer food, for example, products that lower cholesterol have become available (e.g. Becel ProActiv). This growing awareness of the consumer combined with scientific possibilities, gives the functional food industry the opportunity to develop a wide variety of new functional food concepts. According to the EU definition ‘a food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body’ (Diplock *et al.* 1999). Thus, functional foods are foodstuffs of which scientifically has been proven that they have a positive influence on the physiological and/or mental wellbeing of the user.

Because of the growing consumer interest, food producers have realised that functional foods can have an important positive effect on sales. The global market of functional food is estimated up to 33 billion US\$, the European market estimations exceed 2 billion US\$, representing less than 1% of the European food market. Functional dairy products, such as cholesterol-lowering butters, functional yoghurts, are the key product sector (Menrad 2003).

Within the incumbent food industry the producers are aware of the potential of functional foods to provide an important contribution to the increase in sales in this sector (Kleef *et al.* 2005). As the market is characterised by a high rate of product failures, specific efforts in nutritional research, product development and marketing of food (e.g. tasty products, convenience, variety) are necessary to realise long-lasting market success of functional food products (Menrad 2003). Accordingly, in the development of functional foods two aspects play an important role: *technological opportunities* and (market) insight in the *needs and preferences of the consumer*.

From the technological point of view, there are many different techniques to develop a new functional food and a wide range of different kinds of functional foods can be developed. At this moment, the functional foods on the market can be divided into three main categories (Verduijn 2004):

The first category consists of functional foods of which the producers claim that the consumption of these foods have a positive effect on human health (i.e. *health-enhancing*

functional foods). Furthermore, producers of these foods claim that the consumption of these foods reduces the risk of certain diseases. Examples of diseases for which functional foods are developed include cardiovascular diseases, cancer, obesity and diabetes. There are various ways of producing novel food products providing health benefits: 1) by fortifying existing products with additional nutrients, so called *fortified foods* (e.g. fruit juice fortified with additional vitamin C); 2) by adding nutrients that normally are not present in the product, so called *enriched foods* (e.g. margarine with plant sterol esters that have shown to lower blood cholesterol (e.g. Becel ProActiv)); 3) by replacing some potentially harmful or undesirable constituents by more beneficial components, so called *altered products* (e.g. the use of high fibre fat replacers from grain products to reduce fat in products); and 4) the *enhanced commodities*, these include developed products with enhanced content of certain components beneficial for health (e.g. tomatoes with increased production of the nutrient lycopene) (Spence 2006).

The second category consists of functional foods from which producers claim that the consumption of these foods has a positive effect on the physical and mental wellbeing (i.e. *feel good functional foods*). For example, food with high concentrations of carbohydrates supports sleepiness and calming down. Sucrose could diminish stress feelings of children. Also specific food ingredients are studied, such as choline, caffeine and specific amino acids for their effect on the mood and the cognitive performance (Ashwell 2002).

The third category consists of functional foods which can be consumed before, during or after physical exercise (*sport functional foods*) to improve physical performance and recovery. A balanced diet with the precise composition of specific food ingredients, such as re-hydrated products and supplements of micro-nutrients, could play an important role in the improvement of the performance level of an athlete. They also often use energy drinks, with high levels of caffeine and taurin (e.g. AA Energy Drink, Extran Energy) (Ashwell 2002).

Despite the large range of technical possibilities for the development of functional foods, many companies have difficulties with the translation of scientific knowledge in successful new products. An explanation for this can be found in the lack of insight in the needs and preferences of the consumer. For the development of a new successful product it is essential that producers have insight in the consumer's needs and translate these into a new product. However, this raises the question how to conceptualise the consumers needs and preferences in the context of new product developments, so that new innovations can benefit from the creative potential of the users?

3. Conceptual model for consumer needs and preferences

In general, new product development represents a science-based innovation trajectory, carried out by a network of interrelated actors, such as universities, research institutes, producers, government, and consumers, and based on demand-driven conditions, such as unmet needs (Tidd *et al.* 2001). These conditions are reflected in expectations about potential customers and new product innovation, adoption and diffusion.

Needs and preferences of consumers not only become visible in the end stage of new product development but often are articulated throughout the innovation process in for example research agendas of firms, wishes of retailers and experiential knowledge of consumers. By this, consumers (may) introduce important societal aspects in innovation processes (Nelson & Winter 1982; Rip & Kemp 1998).

A broad set of disciplines has focussed on the role of users (consumers) in technology and product development, ranging from evolutionary economics, semiotic approaches and cultural

studies to science, technology and innovation studies. The latter has recently shown that intensified, and well-designed user-producer interaction may increase chances for successful innovations (e.g. Von Hippel 1988, Lundvall 1992, Coombs 2001, Smits 2002, Geels 2002, Oudshoorn & Pinch 2003, Moors *et al.* 2003, Moors *et al.* 2008; Lütje 2003, Rohrer 2005, Lettl 2006, Nahuis *et al.*, 2009, Boon *et al.* 2008, Smits & Den Hertog 2007, Smits & Boon 2008).

New product developments originate from new technologies or from new market possibilities (Eliashberg *et al.* 1997). But the ultimate success of new products is based on the assessment or judgements of the consumer (Brown & Eisenhardt 1995; Cooper & Kleinschmidt 1987). The incorporation of the ‘voice of the consumer’ in the early stages of new product development has been identified as a critical success factor for the development of new products (Van Kleef *et al.* 2005). Consumer oriented studies could be carried out at four different stages of new product development: 1) at the stage of identification of technological opportunities, 2) at the development stage, 3) at the testing stage and at the 4) market launch stage. Most often, consumer research is performed during the development, testing or launching of a new product, while various studies show that successful new product development is mainly based on the quality of the identification of possibilities (stage 1). (Cooper 1985,1988,1998; McGuinness *et al.* 1989, in Van Kleef *et al.* 2005). The goal of the first stage is to search for new ideas or opportunities, which typically involve the unmet needs, ideas and preferences of consumers (Van Kleef *et al.* 2005).

Accordingly, consumer research in an early stage could importantly contribute to increase the chance of a successful product on the market, and could give insights in the way consumers accept products, how consumer needs are formed and influenced, and the way in which product choice is realised (Goldenberg *et al.* 2002; Van Kleef *et al.* 2005). Fig 1 gives an overview of the stages of new product development process along with representative consumer research methods (Van Kleef *et al.* 2005).

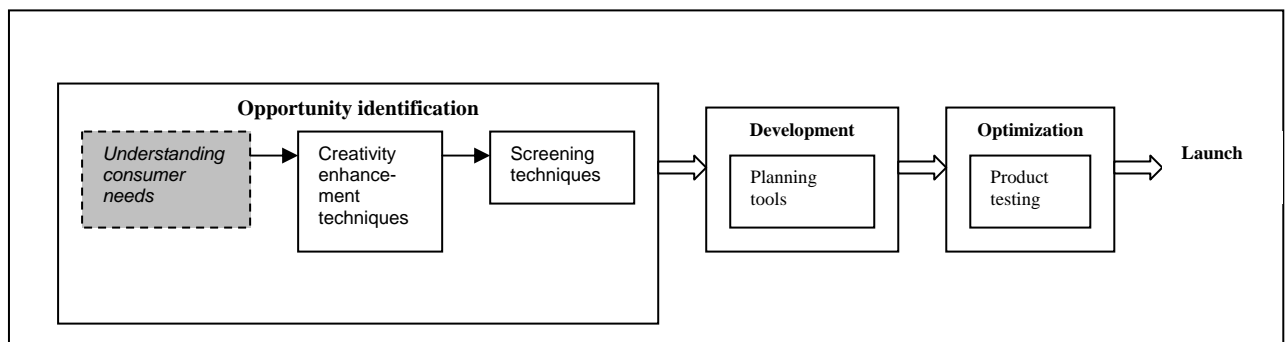


Figure 1: Stages of new product development process and representative consumer research methods (Van Kleef *et al.* 2005:182)

Consumers, however, are not always able to articulate their needs, preferences or wishes, due to the fact that they are not fully aware of all possibilities of a new technology or don't want to share their (creative ideas and opinions). Studies have shown that consumers are often unaware of their underlying choice criteria and aspirations in purchasing a product or choosing one product instead of another (Simonson 1993). People do not have clear and stable preferences, even when they have complete information about the characteristics of alternatives. To a large extent, consumers construct their preferences when faced with a specific purchase decision, rather than retrieve pre-formed evaluations. Moreover, consumers may have needs that they are not aware of, often referred to as 'latent needs'. Consumers do not ask for the fulfillment of these needs and may not be able to articulate them. This is

because products, which could fulfill them probably, do not yet exist. (Griffin & Hauser 1993). Furthermore, novel solutions to people's latent needs can differentiate a product from its competitors and make consumers more loyal (Oliver *et al.* 1997; Van Kleef *et al.* 2005).

Following Van Kleef *et al.* (2005), we make a distinction between consumer needs and preferences: Needs are more general, referring to basic needs such as food, water, air, protection etc. Preferences are more specific and related to concrete objects that could fulfil a particular need, e.g. a particular sport functional food.

This paper focuses on the first part of the new product development process, namely understanding consumer needs and preferences related to the opportunity identification stage of product development. For the analysis, various concepts from the innovation studies literature are chosen. In order to develop a conceptual model, we first have to get insight in the product specific characteristics. Then we will focus on the person-related factors of the consumer and the conditions focusing on consumer needs and preferences.

The functional food related *product characteristics*, such as physical, chemical properties and nutrient content, are the first dimension in the model for understanding consumer needs and preferences. Consumers will choose certain food products to fulfil the necessary nutrient requirements and/or to fulfil their desire to eat a certain product, because of its flavour, texture and appearance. By creating more flavourful food and improving the appearance of food products, consumers are more likely to choose these products. The nutrient content, or what people perceive to be 'healthy food' plays a major role in food choice (Wardlaw *et al.* 2004). The food-related product characteristics can influence consumers' perception, attitudes and acceptance of the functional food product.

Person related factors of the consumer, such as age, gender, level of education, work, household composition, psychological and physiological factors, perception of sensory attributes, attitudes and acceptance are also an important dimension of the conceptual model. Appearance of the product, aroma, taste and texture are examples of the perception of sensory attributes. Personality, experience, mood and beliefs form the psychological factors. Satiety, hunger, thirst and appetite are part of the physiological factors. The attitudes to sensory properties, health, nutrition, price or value and acceptance of the food product are also important indicators (e.g. Urala *et al.* 2007).

In many cases consumers do not yet have precise demand requirements and a clear view of relevant product attributes. Users' needs and possible alignments with technological opportunities cannot be discovered ex-ante as Rosenberg (1976, 1982) stressed. They have to be constructed and negotiated in a process of mutual articulation and alignment of demand and supply. In this process the role of mediators, intermediate agents, advocacy groups or spokespersons could be very relevant. *Intermediate agents* are actors who facilitate interaction between consumers and producers, often bridging the knowledge gap between them. They could be regarded as brokers between consumers and producers in order to create mutual understanding and articulation and alignment of demand (consumption and user requirements) and supply (production and product characteristics) (Boon *et al.* 2007; Van Lente *et al.* 2003; Hoogma & Schot 2001). Important intermediate agents for functional food developments are consumers and patient organisations, dieticians, supermarket organisations, venture capitalists, organisations that inform the public in general such as the Dutch Food Centre (Nederlands Voedingscentrum), the media and industry associations (Moors *et al.* 2003).

The most important success factor for the market introduction of new functional foods is that the health claims of these products are waterproof. When no scientific evidence on efficacy

and safety can be given, users will find it difficult to *trust* the producers and will hesitate to buy these new food products. Trust is an important factor in the interactions between producers and users. Without mutual trust, efficient and effective interactions will not be possible (Lundvall 1992). Therefore, an important starting point for the food industry is that the claims of new food products with specific health enhancing effects can be scientifically proven (Enzing & Van der Giessen, 2002). Trust is not only related to waterproof health claims, but also to the extent to which producers handle food scandals. Food scandals like the dioxin, BSE, and mouth-and-feet-disease have harmed the consumer trust in the safety and quality of food. Although producers claim that they do everything to assure quality and safety, the consumer is sensitive to incidents and campaigns of societal pressure groups. Clear, harmonized governmental regulation about food claims etc. would possibly help to create consumers' trust (Moors *et al.* 2003).

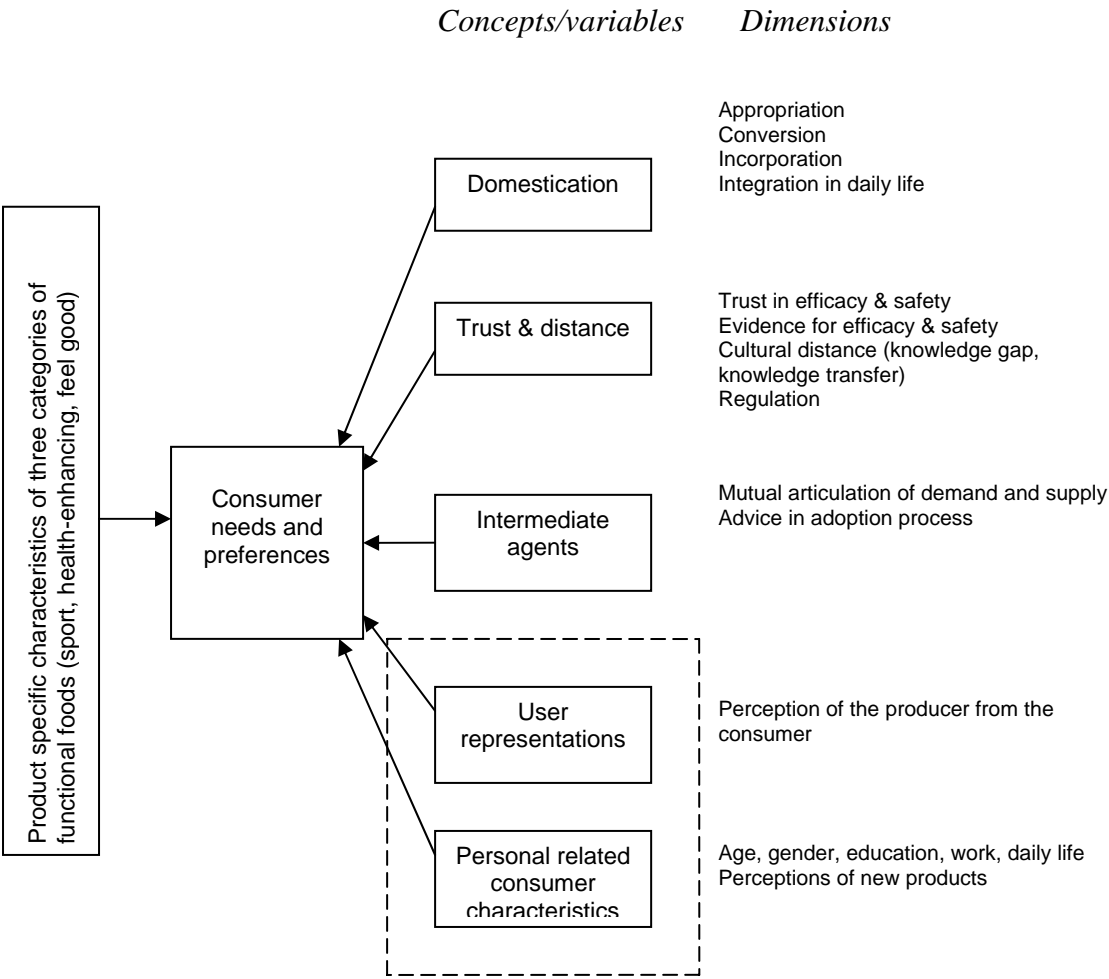
Furthermore, consumers lack knowledge about food production methods and find it difficult to understand technological developments such as functional food innovations (Stichting Merkartikel 2002). This gap in knowledge increases the social and cultural *distance* between consumers and producers and this could hinder effective interactions between them (Lundvall, 1992). This lack of knowledge also stimulates the lack of trust, because users fear new products and services based on technological developments. Therefore, consumer acceptance of these new products and services is lacking and consumers are rather sceptical about food products with health benefits. Verbeke (2005) showed that believing in the health effects of functional foods is the most crucial factor affecting the consumers' acceptance.

The process of *user representations* is a method for producers to deal with the uncertainty on the demand side when products are radically new and there is no established market yet. User representation is the outcome of “techniques employed by system designers to construct and then appropriate [...] representations (in a cognitive and political sense) of what the supposed users are and what they want” (Akrich 1995,p.168). When the consumer needs and preferences are heterogeneous, representativeness cannot be taken for granted (Nahuis *et al.* 2008). In order to deal with this heterogeneity, producers are interested in their future users and they construct many different representations of these users, and objectify these representations in technical choices. The problem is how to take the various *user representations* into account and to combine them in order to develop a product that fits a coherent combination of these user representations. Thereby, the concept of *script* (Akrich 1992) can be helpful. Through functional food innovations, new professionals (such as medical and pharmaceutical researchers) will be involved in food development. This change in relationship between actors and their products can be analysed from the ‘script’ that the food product ‘holds’ (Moors *et al.* 2003).

Users do not simply accept or reject innovative technologies, but have to ‘domesticate’ them. *Domestication* of technology refers to the practices and consequences of incorporating new technological products in daily lives (Silverstone and Hirsch 1992). Domestication is an active process in which the very meaning and use of new technologies are (re)shaped, and, consequently, the social identity of users themselves when users integrate novelties into their daily lives and social relations. Accordingly, the domestication process analyses how consumers really use the new products, how users integrate the new technology or product that has already left the design stage into their daily life, and in which consumers give meaning to a technology and thus reveal new applications for the innovation. Thus, domestication refers to the capacity of users to bring new technologies and services into their own culture and practice. After the actual development and production of the new product and attaching functional and symbolic values to them (process of commodification), the users

will actually buy or receive the new product. This process of *appropriation* shows whether the users are using the product as intended and expected by the producer. *Incorporation* reflects *how* consumers make use of a specific product. Users can also show their use and consumption of these new products to the outside world. In this way the users are connected to the public world of shared meanings and claims and counterclaims of status and belonging. This process is also called *conversion*. Functional food developments could lead to the use of improved food (e.g. better flavour, texture, increased nutritional value) and foods with enhanced health properties such as pro-biotics and nutritional supplements. This could lead to a conversion from eating for feeding to eating for health. Functional food products will also meet the increasing awareness of quality of food. Eating food is no longer a necessity to survive, but eating food increasingly gets culinary and social characteristics. To what extent the consumer actually decides to buy the new food product also depends on what the consumer thinks of its innovativeness. This implies that producers should inform the consumers and provide consumer tests already in an early stage of the development process. Furthermore, the producer should not be too much far ‘ahead’ of the consumers, otherwise the consumers will find it difficult to understand the newness and the benefits of the new products

Summarising, Figure 2 gives the concepts and dimensions, which have been identified as being important in understanding consumer needs and preferences in the context of new product development.



○ **Figure 2.** Conceptual model for understanding consumer needs and preferences in new product development

4. Research methodology

4.1. Operationalisation of concepts

The concepts in Fig. 2 have been operationalised according to their empirical facts as discussed in Section 3.

Regarding the *product specific characteristics* the properties of the various categories of functional foods (i.e. health-enhancing, feel good and sport functional foods) are presented in the model, including taste, ease of use, availability, proven safety and efficacy, affordability, and price.

Various types of consumers exist, all dealing differently with new products. By studying these personal related consumer characteristics, that is who is the actual consumer of a functional food product (age, gender, education level, job etc), how is (s)he dealing with new products and information, and which products would (s)he choose and why, indicates how various types of consumers assess various categories of new products (i.e. functional foods). Various consumers could also have different *perceptions* of functional foods, based on the sensory attributes and psychological and physiological factors. The dotted line in the conceptual model indicates that the consumer characteristics are correlated with the user representations.

User representations are indicated by the perception of the producer from the consumer needs. Studying whether the products are in line with the needs and preferences of the consumers gives an indication of the influence of these representations on the product assessment of the consumer.

Intermediate agents take care of the mutual articulation of demand and supply and provide aid with the adoption process of a new product. Indicators are: various types of intermediaries and their advising role in the product adoption process.

Domestication refers to the practices and consequences of incorporating new products in daily lives. The domestication process consists of three parts: *Appropriation* deals with the fact whether users use a product as meant by the producer. *Conversion* describes whether users give also other applications to existing products. *Incorporation* reflects *how* consumers make use of a specific product. Furthermore the domestication process is influenced by the extent to which the new products are integrated in the daily life and customs of the consumer (e.g. eating habits, sport, work etc). When a new product fits easily these customs, it can be more easily incorporated by the consumer in his daily living pattern. To what extent are these dimensions of the domestication process influencing the consumer need of various categories of functional foods (i.e. feel good, health-enhancing and sport functional foods).

Trust could be divided in trust in *safety* and trust in *efficacy* of a new product. For food innovations, efficacy (working of the product) and safety (adverse side effects) are important indicators. The *distance* between consumer and producer is indicated by the distance in knowledge and the accessibility of the producer. Consumers have limited knowledge of production methods and technologies, making it difficult for them to understand the various technological opportunities. Difference in knowledge enlarges the social and cultural distance between consumers and producers and accordingly, an effective interaction between them. The larger the knowledge difference between consumer and producer, the larger is the cultural distance, making it more difficult for a consumer to trust a new product. When consumers understand a new product and its applications, the chance that the product will be integrated in their daily life increases. There are various ways to bridge this cultural distance, amongst others via information provision from various sources. Also, clear governmental regulation on claims etc. could increase the trust by the consumer.

4.2. Data acquisition

Based on the dimensions mentioned in Figure 2, a survey on consumer needs and preferences was prepared. The questionnaires were sent to respondents, recruited from the database of OP&P Product Research in the Netherlands. OP&P Product Research provides the food industry with consumer insights concerning product properties and product use and provides guidelines for R&D and new product development. The respondents are naïve consumers who are not trained nor experts, but represent the final target group. The database contains approximately 5000 consumers in the Utrecht region, varying in age between 4 and 75 years (www.opp.nl 2008).

The questionnaire contained questions on possible indicators of the concepts in Figure 2, such as the age, gender, level of education, daily work, household composition, amount of money spent on functional foods, the interest in sport, feel good and health functional foods, the knowledge about new functional food products, the way of information gathering, the source of information used, issues around efficacy and safety of sport, feel good, and health functional foods, frequency of using functional foods etc. The questionnaire was sent to 460 consumers and returned by 212 respondents, leading to a response rate of 46%.

Furthermore, we worked with *focus* groups, an explorative test form based on group discussions. First, an inventory of the relevant functional food product characteristics in the eye of the consumers take place, followed by assessments of a series of functional food products on these characteristics. Such focus groups provide quick insight in the ideas, needs and preferences of consumers regarding functional foods and in the similarities and differences between products and in the fit between concept and product. Focus group discussions with a small amount of consumers are important source of qualitative data gathering. The aim of the focus groups is to provide insights into the motives behind consumer needs and preferences with regard to new product development, that is new functional food innovations. Such information cannot be obtained by using written questionnaires. Two focus group sessions have been organised.

4.3. Data analysis

In order to show which dimensions of the conceptual model are important for the consumers, we applied Principal Component Analysis (PCA) with varimax rotation on the different variables. This factor analysis technique is a method to recap a number of variables in a limited amount of underlying clusters of related variables or dimensions. This analysis studies whether there are cluster variables representing the same underlying dimension or factor. By using factor analysis the set of indicators has been reduced to a limited amount underlying dimensions. The scores of these underlying dimensions will be analysed. The factor analysis demonstrates that specific variables show a high correlation with the other variables. The highest correlating variables are on top of the tables (see Appendices). The highest scoring indicators are represented as components. Component 1 gives the highest correlation with the first indicators, component 2 gives the highest correlation with the subsequent indicators etc. Thus, PCA shows which dimensions were most representative for the different variables in the conceptual model.

5. Results

5.1 Results consumer survey research

The results of the consumer survey research are discussed per variable of the conceptual model and for the various categories of functional foods, that is sport, health-enhancing and feel good functional foods.

5.1.1 Domestication

The Principal Component Analysis (PCA) showed that two dimensions are at the basis for the domestication variable of the sport functional foods category, namely the frequency of doing sport and the ease of use. For the categories health-enhancing and feel good functional foods only one dimension, ease of use, is at the basis of the domestication process. See Appendix 1.

5.1.2 Trust and distance

For both sport and feel good functional foods two dimensions have an important influence on the variable trust and distance. First the dimension ‘ease of finding information’. Furthermore ‘uncertainty about efficacy and safety’ is an important dimension for trust and distance.

For sport functional foods the specific source of evidence influences to what extent the functional food is trusted. Table 1 shows that the evidence about safety and efficacy should be provided by an independent scientific organisation.

Table 1. Overview of organisations which, according to the consumer, should deliver the evidence for efficacy and safety of sport functional foods.

Proof of efficacy and safety by

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Producer	33	15.6	15.6	15.6
(Top)sporters	15	7.1	7.1	22.6
Independent scientific organisation	107	50.5	50.5	73.1
Government	16	7.5	7.5	80.7
Consumer organisation	8	3.8	3.8	84.4
Voedingscentrum	31	14.6	14.6	99.1
Other	2	.9	.9	100.0
Total	212	100.0	100.0	

Regarding health-enhancing functional foods it is important for consumers that the information is easy accessible. Furthermore, uncertainty about safety and efficacy is an important indicator for the assessment of trust and distance of the food product. Table 2 shows that also for health-enhancing functional foods the consumers would like to obtain the proof of safety and efficacy by an independent scientific organisation.

Table 2. Overview of organisations which, according to the consumer, should deliver the evidence for efficacy and safety of health enhancing functional foods.

Proof of efficacy and safety by:

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Producer	35	16.5	16.5	16.5
Dieticians	9	4.2	4.2	20.8
Independent scientific organisation	113	53.3	53.3	74.1
Government	21	9.9	9.9	84.0
Consumer organisation	5	2.4	2.4	86.3
Voedingscentrum	26	12.3	12.3	98.6
Other	3	1.4	1.4	100.0
Total	212	100.0	100.0	

For feel good functional foods it is important for consumers to obtain the information about these products in an easy way. The uncertainty about efficacy and safety is, again, an important indicator for the variable trust and distance regarding these products. More doubt indicates less trust. Furthermore, more information about feel good functional foods leads to higher purchasing of the product. Again, consumers want the proof of efficacy and safety by an independent scientific organisation (Table 3, see also Appendix 2).

Table 3. Overview of organisations which, according to the consumer, should deliver the evidence for efficacy and safety of feel good functional foods.

Proof of efficacy and safety by :

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Producer	38	17.9	17.9	17.9
Psychologists	6	2.8	2.8	20.8
Independent scientific organisation	123	58.0	58.0	78.8
Government	21	9.9	9.9	88.7
Consumer organisations	5	2.4	2.4	91.0
Voedingscentrum	17	8.0	8.0	99.1
Other	2	.9	.9	100.0
Total	212	100.0	100.0	

5.1.3 Intermediate Agents

The results of the PCA on intermediate agents (Appendix 3) show for sport and health-enhancing functional foods the dimension ‘independent organisation is necessary’ as the basis for the variable Intermediate Agents. For the feel good functional foods this dimension is less important. Appendix 4 gives an overview of the sources of information consumers use to obtain information. The comparison how consumers are now gathering information on functional foods with how they would like to do this in the future, gives potential points of improvement for intermediate agents. Analysing these data shows that at the moment consumers obtain their information on sport functional foods (p -value = 0.002) mainly via family, friends or acquaintances. They would like to obtain this information from the producer self. The analysis further shows that consumers obtain only a little information from well-known intermediate agents. According to the consumers the Dutch ‘Voedingscentrum’ is the only intermediate agent which should play a role in information services. Regarding health enhancing functional foods (p -value table = 0.011), the consumers obtain their information from the producer self. A considerable part of information is also acquired from family, friends or acquaintances. According to the consumers the information should come from the Dutch Voedingscentrum or a scientific institute. With regard to feel good functional foods (p -value < 0.0005) most information also comes from the producer and that should also be the case according to the consumer. The most important intermediate agents which should supply information is according to the consumer a scientific organisation.

Fig 3 shows which information sources consumers currently use for obtaining information about the different categories functional foods, and which information sources they would like to use to obtain this information (p -value < 0.0005). At present, information about health enhancing and feel good functional foods is obtained via advertisements on TV and radio. Information about sport functional foods is particularly obtained via information on the packaging. This packaging information is also preferred by the consumer as source of information on sport functional foods. The same holds for the desired source of information for health enhancing and feel good functional foods.

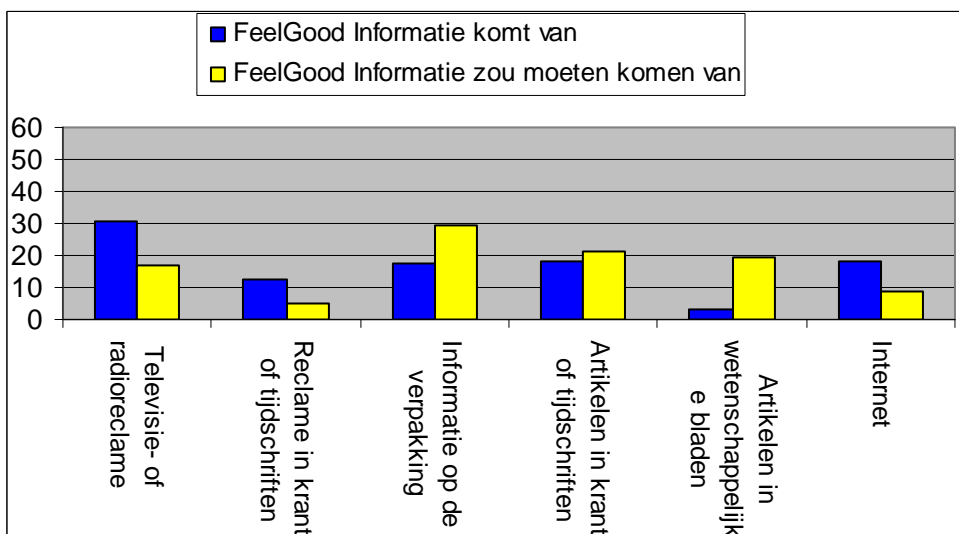
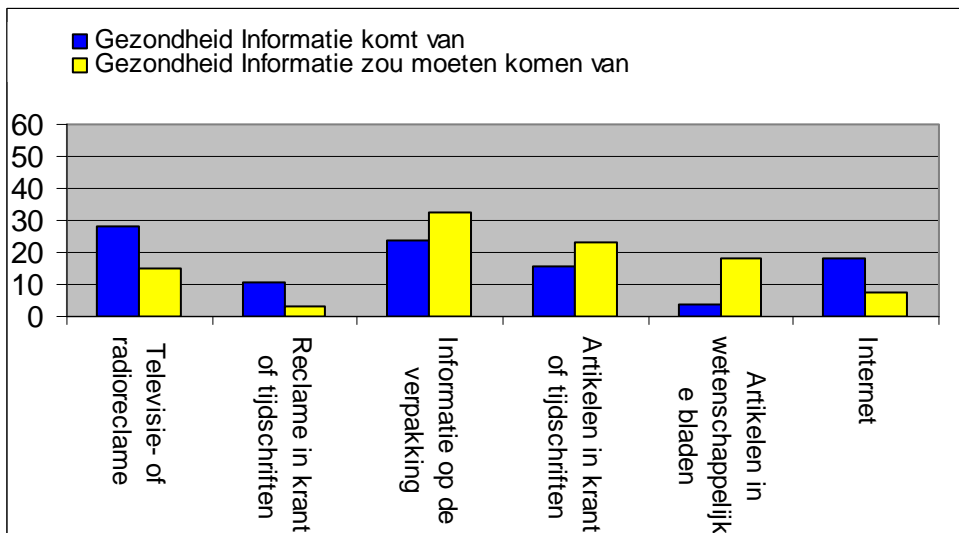
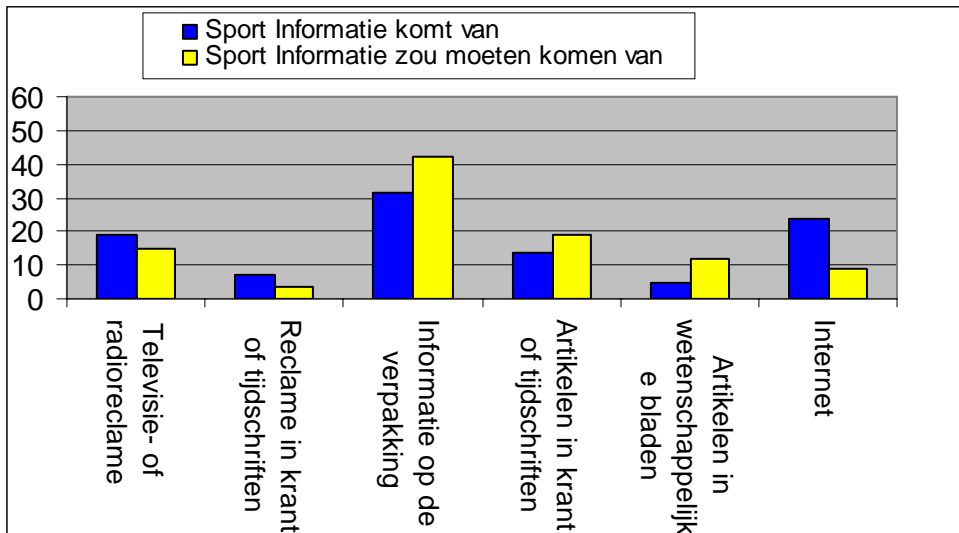


Figure 3. Overview of current and desired information sources. The horizontal axes give the various sources of information. The vertical axes give the percentage consumers choosing a specific source.

5.1.4. User representations

The PCA analysis on user representations shows differences between the three discerned categories of functional foods (Appendix 5).

For sport functional foods two dimensions are most representative for user representations. Firstly, the ‘supplety’, meaning that for sport functional foods the products correspond to the needs arising during doing sport. Secondly, the supply of sport functional foods is okay, implying that producers have a good insight in the needs of the consumer.

For health enhancing functional foods, three variables are at the basis of the user representations. Firstly, the ‘supplety’, implying for health-enhancing functional foods that the products could be a source for specific essential raw materials. Secondly, the ‘deficits’, implying that consumers also really have problems for which health enhancing functional foods are developed. Thirdly the prevention, indicating that consumers think that functional foods could contribute to the prevention of specific problems.

For feel good functional foods two dimensions are important for users representations. Firstly, the ‘supplety’, indicating that feel good products could solve specific physical and psychological well-being problems. Secondly, prevention, meaning that consumers have specific problems which could be solved by using feel good functional foods.

5.1.5. Personal related consumer characteristics

Analysing the various consumer characteristics (i.e. age, gender, education level, daily work, household composition) and their interest in the three categories of functional foods, four combinations turn out to be significant:

Firstly, there is a correlation between age and interest in sport functional foods (p -value = 0.022). Young people are more interested than older ones, the interest is decreasing when age increases (see Fig. 4).

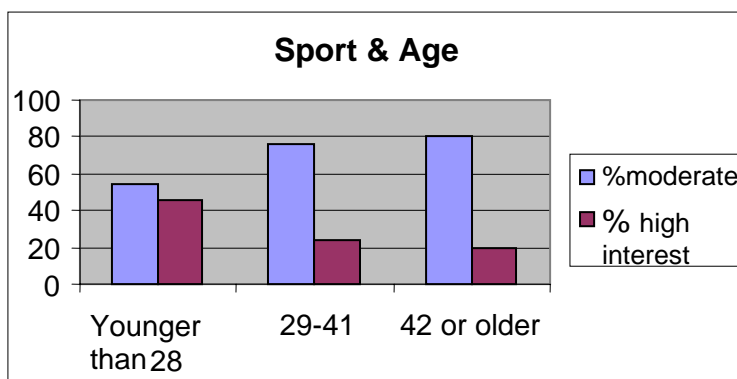


Figure 4. Relation between age and interest in sport functional foods

Secondly, age is also correlated with the interest in feel good functional foods (p -value = 0.055). Older consumers are less interested in these products (see Fig 5).

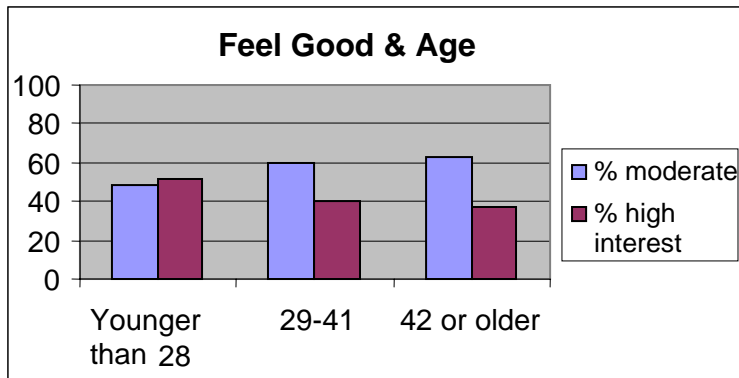


Figure 5. Relation between age and interest in feel good functional foods

Thirdly, gender of the consumer is correlated with the interest in sport functional foods (p-value = 0.031). Male consumers are more interested in sport functional foods than women (Fig 6).

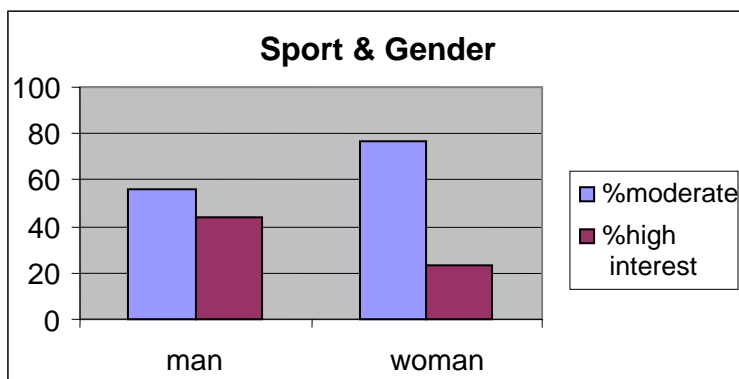


Figure 6. Relation between gender and interest in sport functional foods

Fourthly, the daily work of consumers is correlated with the interest in sport functional foods. Especially students are interested in sport functional foods. No difference has been found between part-timers and full-timers regarding interest in sport functional foods. People with no job are not interested in sport functional foods (Fig 7).

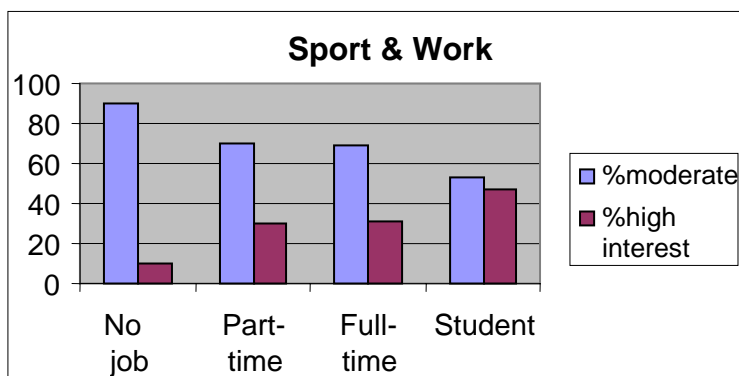


Figure 7: Relation between daily work and interest in sport functional foods

For the other consumer characteristics no significant correlations with the various categories of functional foods are found.

5.1.6 Product specific characteristics

The PCA analysis of the variable ‘product specific characteristics’ (Appendix 6) shows for all three categories functional foods that all product specific characteristics correlate, except for the brand of the products. Furthermore, for health enhancing functional foods, it turns out that the ease of use correlates to a certain extent with the other product specific characteristics.

5.2 Results Focus Group meetings

The most important concepts of the conceptual model which have been emphasised by the focus group members were: trust in the producer, the intermediate agents, user representations and the product characteristics. These are briefly discussed below.

Trust

The group members have relatively little trust in health enhancing functional foods. This lack of trust is an important reason for not buying these products. They have more trust in drug producers than in food producers. Food products with a strong medical character are ‘scary’, due to the limited control on the dose and use by the right target group. The members don’t expect functional foods to take over the role of pharmaceutical drugs in the future. A strict distinction between medicinal drugs (strict control) and food products is necessary.

In the future, food producers should focus on gaining trust of the consumers by means of producing safe and effective products, by which safety and efficacy has been proven by an independent, trustworthy organisation. Additionally, producers should give the consumers the possibility to try out the products and to experience their functionality.

Intermediate agents

There is a shortage on information supply about functional foods. It was not clear when a functional food product really was ‘functional’. It is not clear who is guarding the safety and efficacy. A clear and reliable quality symbol should be put on the packaging of those specific products. This increases the transparency by choosing between various food products.

Reliable information about functional food products should be given by general practitioners and dieticians. Also TV programs about product quality and comparisons, investigating to what extent the trust in a product is justifiable, would be a good source for reliable information.

User representations

With regard to user representations the producers not always have a correct perception of the needs and wishes of the consumer. The group members don’t need functional foods, and when these products were not developed, they wouldn’t miss them. Now that these are in the supermarket, they try them out. They are fairly sceptical about functional foods. In general they have a perception of functional foods and are sometimes willing to try them. None of them uses functional foods daily, because they are not convinced that functional foods lead to a significant health enhancing contribution. Effects of the use of functional foods are not measurable directly and furthermore, none of them have a problem for which functional foods could provide a remedy. Additionally, they found the price of functional food products high compared to the effects and compared to normal healthy food products.

Product characteristics

Consumers think price is the most important product characteristic of functional foods. Due to the high price of functional foods consumers are not easily willing to buy functional foods. A lower price makes that consumers could base their choice of food products on functionality

and not on price. Another important characteristic in the assessment of functional foods is the taste of these products. Taste influences the food decision process. If the taste is not good, the product won't be used. Because the effects of functional foods are not measurable (yet), the functionality plays a minor role than the taste.

6. Concluding remarks

The aim of this paper was to understand the needs and preferences of consumers in the context of new product development, in particular regarding functional foods. These insights could lead to recommendations for the development of successful functional foods, based on the unmet needs and preferences of consumers.

Firstly, this paper focused on functional foods developments and divided these in three categories: sport, feel good and health enhancing functional foods. The literature on new product development and science, technology and innovation studies lead to the development of a conceptual model with the most important variables and dimensions playing a role in the need and preferences of consumers with regard to new products. In order to investigate whether and to what extent these variables really are important, a survey was sent to 460 consumers, with a response rate of 46%. Furthermore, focus group discussions with consumers have been organised to obtain insights in the motives behind the needs and preferences of consumers regarding the various categories functional food products.

The analysis of the variables of the conceptual model gives important points of attention for the producer regarding the development of successful new functional foods in the future. These variables include domestication, trust (and distance), intermediate agents, user representations, personal-related characteristics of the consumer, and product specific characteristics.

The most important conclusions regarding *domestication* are: Firstly, the ease of use is for consumers an important quality, and, secondly, the frequency of doing sports is an important dimension for the domestication of sport functional foods. The results show that for the three categories of functional foods the ease of use in daily life is the most important dimension for the variable domestication of functional foods.

The most important conclusions regarding *trust and distance* are that the information about the functional food product usually is easy to find, but that uncertainty exists about the efficacy and safety of the functional food products. An independent organisation or institute should be created which provides proof for the safety and efficacy of functional foods. Furthermore, there is a need for an independent quality symbol (Keurmerk), so that consumers know when they can trust the claim on a functional food product.

The most important conclusions regarding *intermediate agents* in functional food assessment are that intermediate agents play no role as distributor of information. The consumers find that the producer should provide this information, especially for sport functional foods, and should give more attention to direct information supply, and that information about the efficacy of the product need to be put on the packaging. This implies that consumers are able to find information about functional foods without the help of intermediate agents, and to use this for the assessment of functional food products. Only the Dutch Food Centre (Voedingscentrum), was mentioned as a possible intermediary which could play a role in information supply about health-enhancing and feel good functional foods. For evidence on efficacy and safety of functional foods producers need to make use of an independent scientific institute, as consumers find it very important that such evidence is provided by an independent institutes (comparable with FDA for pharma products).

The most important conclusions regarding *user representations* are that functional foods are used by the intended target group, being persons with a specific problem for which the functional food could lead to an improvement. Furthermore, consumers think that functional foods can be used for specific problems, and consumers are satisfied with the solutions offered by the existing functional foods. The consumers really need to have a problem which could be solved by using a functional food. The assessment takes place based on the fact whether the producer has developed products which offer specific solutions for the problems of the user. Accordingly, the producer needs a well developed insight in the (potential) problems of the user.

Consumers regard the brand as a separate *product characteristic*. All other product characteristics (i.e. taste, price, availability, safety, efficacy, and ease of use) are in the same way assessed for the three categories of functional foods by the consumers. The group discussions reveal that specific product characteristics were more important than others: Taste and price are the most important product characteristics for the assessment of functional foods.

Conclusions regarding *personal-related consumer characteristics* are: the age influences the interest in sport and feel good functional foods: Young people are more interested than older ones in these categories. Gender is important for the interest in sport functional foods, with men being more interested. Daily work of consumers influences the interest in sport functional foods. Students are more interested than people with or without a job in sport functional foods.

Summarising, functional food producers should stay focused on consumers with specific needs, such as athletes, women, obese persons, people with a tendency to stress etc. This will help in developing products in accordance with the needs, preferences and life patterns of the consumers. In addition, producers should pay more attention to the way in which they provide product information to the consumers. Consumers prefer clear and transparent, easy accessible, information directly from the producer. Also, an independent organisation should control the efficacy and safety of functional foods, using a quality symbol on the packaging. This enhances the trust between consumers and producers of new functional foods. Furthermore, efficacy, brand, taste and price appear to be important consumer needs and preferences regarding new product developments, especially functional food innovations.

The results presented in this study should be regarded as tentative due to the exploratory nature of the research carried out. Further research should be conducted along three lines of research. Firstly, the same research can be conducted in other Western countries. The results obtained from these studies could be combined with those from the Netherlands to carry out a more reliable international comparative study. Secondly, if in the future various new functional foods are introduced to the international market, functional food development trajectories can be compared on a case study basis and the motives behind consumer needs and preferences could be studied more in depth. Thirdly, in the future more market specific consumer research on emerging functional food developments should be done. This will lead to the development of products which are better suited for specific types of consumers, thereby discriminating between more categories of functional foods. For example, Van Kleef *et al.* (2005) provide guidelines for the appropriateness of specific consumer research methods in new product development processes based on the newness strategy of the development process. In this way, radical new functional food innovations, for example based on nutrigenomics developments, could be differentiated from more incremental food innovations. Future research should also provide insight into the extent to which the results found in this study are valid in other categories of new product developments, thereby producing some insight into the reliability of these results on consumer needs and preferences.

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Appendices

Appendix 1: Domestication

SPORT			
Rotated Component Matrix(a)			57,00
	Component		
	frequency	easy use	
Hoe vaak sportvoeding?	0,80	0,33	
Hoe vaak sport?	0,77	-0,31	
Makkelijk in gebruik	0,13	0,75	
Volg aanwijzingen verpakking?	-0,18	0,64	
Sportvoeding ook tijdens niet-sport.	0,39	0,49	
Extraction Method: Principal Component Analysis.			
a	Rotation converged in 3 iterations.		

HEALTH			
Component Matrix(a)			45,00
	Component		
	1,00		
Makkelijk in gebruik	0,74		
Voldoet aan wensen	0,72		
Gebruik ondanks geen problemen	0,67		
Hoe vaak?	0,66		
Volg aanwijzingen verpakking?	0,54		
Extraction Method: Principal Component Analysis.			
a	1 components extracted.		

FEEL GOOD			
Component Matrix(a)			43,00
	Component		
	1,00		
Makkelijk in gebruik	0,76		
Huidige aanbod voldoet	0,70		
Gebruik ondanks geen problemen	0,69		
Hoe vaak?	0,63		
Volg aanwijzingen verpakking?	0,45		
Extraction Method: Principal Component Analysis.			
a	1 components extracted.		

Appendix 2: Trust and Distance

SPORT				
Rotated Component Matrix(a)				60,00
	Component			
	info	twijfel	info=kopen	
Info is eenvoudig te vinden	0,76	-0,13	-0,11	
Veel bekend over werking van sportvoeding	0,66	-0,14	0,28	
Producenten sportvoeding eenvoudig te benaderen	0,64	-0,21	-0,28	
Op de hoogte van mogelijkheden sportvoeding?	0,61	-0,02	0,05	
Twijfel aan veiligheid	-0,04	0,83	0,06	
Twijfel aan effectiviteit	-0,17	0,78	-0,37	
Regelgeving is goed	0,19	-0,64	-0,16	
Meer info zorgt voor eerder kopen	-0,03	0,02	0,90	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a	Rotation converged in 4 iterations.			

GEZONDHEID				
Rotated Component Matrix(a)				54,00
	Component			
	info	no-twijfel		
Informatie is eenvoudig te vinden	0,84	0,17		
Veel bekend over werking gez.prod	0,78	0,19		
Ben op hoogte van mogelijkheden	0,74	0,10		
Producent eenvoudig te benaderen	0,63	0,27		
Twijfel aan effectiviteit	-0,21	-0,79		
Twijfel aan veiligheid	-0,19	-0,76		
Regelgeving is goed	0,26	0,46		
Meer info zorgt voor eerder kopen	-0,39	0,44		
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a	Rotation converged in 3 iterations.			

FEEL GOOD				
Rotated Component Matrix(a)				66,00
	Component			
	info	twijfel	info=kopen	
Info is eenvoudig te vinden	0,86	-0,12	-0,06	
Producenten eenvoudig te benaderen	0,73	-0,15	-0,08	
Veel bekend over werking	0,70	-0,39	0,04	
Op de hoogte van mogelijkheden feel good?	0,67	-0,03	0,12	
Twijfel aan effectiviteit	-0,12	0,86	-0,14	
Twijfel aan veiligheid	-0,08	0,82	0,06	
Regelgeving is goed	0,38	-0,52	-0,07	
Meer info zorgt voor eerder kopen	0,01	-0,02	0,98	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a	Rotation converged in 4 iterations.			

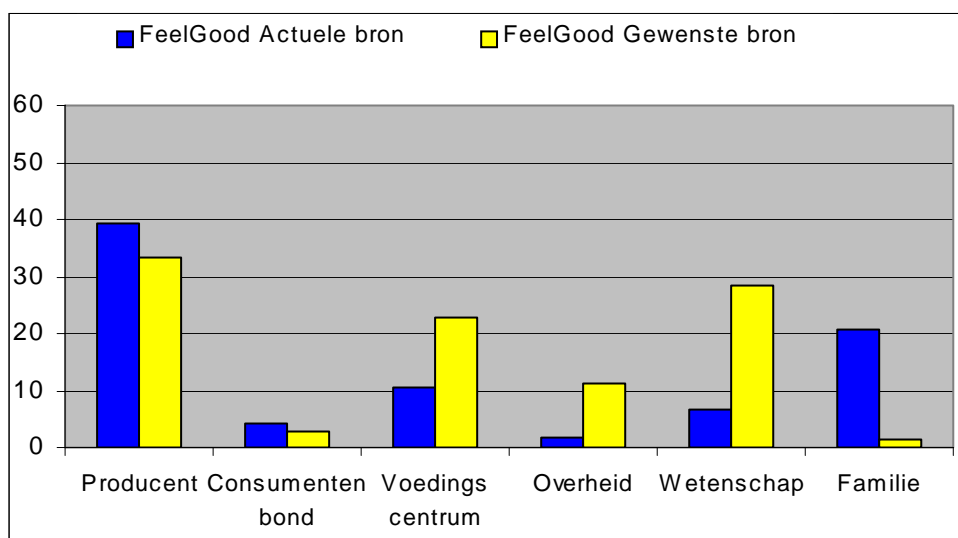
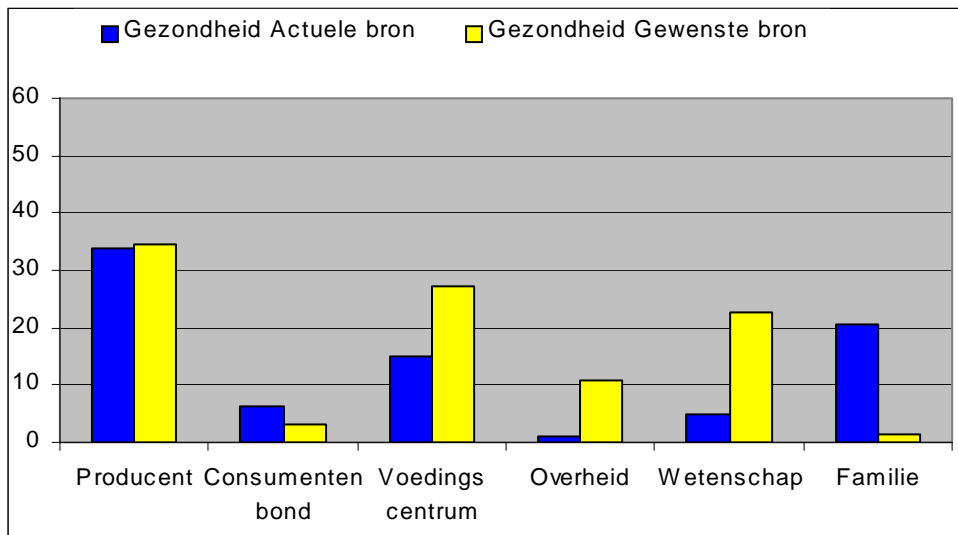
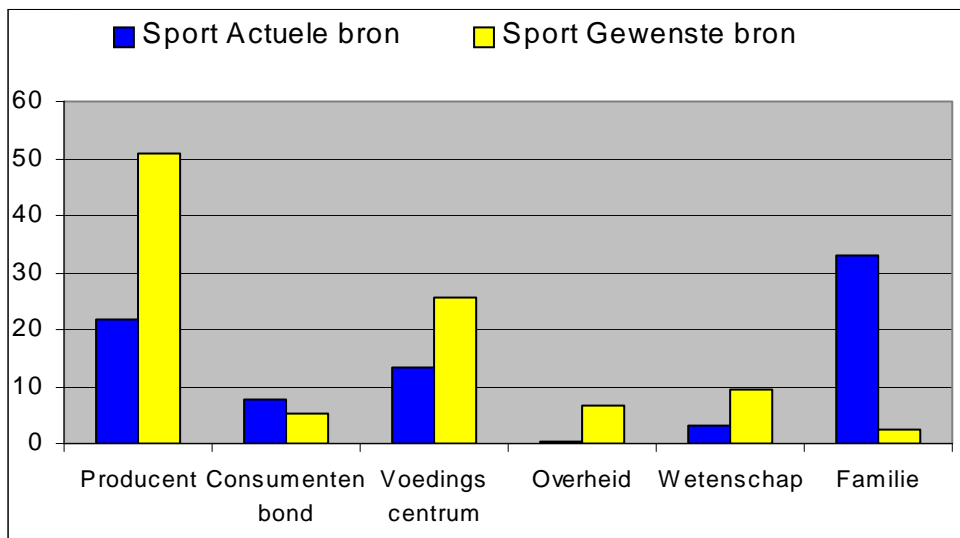
Appendix 3: Intermediate Agents

SPORT			
Component Matrix(a)			0,53
	Component		
	1,00		
Onafhankelijke instantie is nodig	0,73		
Duidelijk tot wie te richten met vragen	0,73		
Extraction Method: Principal Component Analysis.			
a	1 components extracted.		

HEALTH			
Component Matrix(a)			57,00
	Component		
	1,00		
Onafhankelijke instantie is nodig	0,75		
Duidelijk tot wie te richten met vragen	0,75		
Extraction Method: Principal Component Analysis.			
a	1 components extracted.		

FEEL GOOD			
Component Matrix(a)			51,00
	Component		
	1,00		
Duidelijk tot wie te richten met vragen	0,71		
Onafhankelijke instantie is nodig	-0,71		
Extraction Method: Principal Component Analysis.			
a	1 components extracted.		

Appendix 4: Information tables



Appendix 5: User representations

SPORT			
Rotated Component Matrix(a)			0,62
	Component		
	supplety	aanbod ok	
Sportvoeding goede bron vocht	0,83	0,19	
Mineralen moeten aangevuld	0,82	0,01	
Behoeftte aan bron vochtbalans	0,78	-0,18	
Tijdens sport behoefte energie	0,78	0,03	
Sportmiddelen goede bron mineralen	0,77	0,36	
Sportmiddelen zijn goede energiebron	0,73	0,31	
Producent heeft goed inzicht	0,19	0,81	
Aanbod voldoet	0,47	0,66	
Hoe vaak?	0,23	-0,38	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 3 iterations.		

HEALTH			
Rotated Component Matrix(a)			0,62
	Component		
	supplety	tekorten	preventie
Becel goede oplossing?	0,78	0,01	0,24
Voeding met vitamines oplossing?	0,70	0,21	0,23
Calciummelk oplossing?	0,66	0,15	0,29
Producent heeft goed inzicht	0,57	0,11	-0,37
Tekort calcium	0,14	0,83	0,17
Tekort aan weerstand	0,17	0,81	0,18
Risico op hvz	0,05	0,68	0,01
Om problemen te voorkomen	0,38	0,11	0,78
FV goede oplossing voor mijn problemen	0,47	0,06	0,68
Door problemen	-0,01	0,25	0,68
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 6 iterations.		

FEEL GOOD			
Rotated Component Matrix(a)			66,00
	Component		
	supplety	preventie	
FV kan energie geven	0,82	0,04	
FV kan stress verlichten	0,80	0,35	
FV goede oplossing voor psych.gez.heid	0,79	0,12	
FV kan ontspannen	0,74	0,42	
Behoeftte aan energie	0,60	0,39	
Psych/lich. klachten zorgen voor behoefte fv	0,58	0,25	
Stressgevoelig	0,21	0,90	
Moeite met ontspannen	0,22	0,89	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 3 iterations.		

Appendix 6: Product specific properties / characteristics

SPORT			
Rotated Component Matrix(a)			0,65
	Component		
	belang rest	belang merk	
Doeltreffendheid	0,83	0,09	
Veiligheid	0,79	-0,01	
Prijs	0,77	-0,08	
Smaak	0,76	0,10	
Gebruiksgemak	0,66	0,43	
Beschikbaarheid	0,64	0,37	
Merk	-0,02	0,94	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 3 iterations.		

GEZONDHEID			
Rotated Component Matrix(a)			58,00
	Component		
	belang rest	belang merk	
Doeltreffendheid	0,77	0,09	
Veiligheid	0,71	0,00	
Prijs	0,70	-0,16	
Beschikbaarheid	0,68	0,29	
Smaak	0,65	0,20	
Merk	-0,11	0,89	
Gebruiksgemak	0,50	0,61	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 3 iterations.		

FEEL GOOD			
Rotated Component Matrix(a)			66,00
	Component		
	belang rest	belang merk	
Doeltreffendheid	0,85	0,05	
Veiligheid	0,79	-0,04	
Prijs	0,76	-0,02	
Smaak	0,74	0,16	
Beschikbaarheid	0,68	0,26	
Gebruiksgemak	0,66	0,45	
Merk	0,02	0,95	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a	Rotation converged in 3 iterations.		