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Factors influencing consumers' adoption of and resistance to functional food product innovations

An empirical investigation into adoption and resistance to functional food product innovations among German customers, to provide new opportunities in health claims regulated markets

- Master Thesis -

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Abstract

Foods with added health benefits, known as functional foods, are trending with consumers and provide potential for innovation and differentiation for suppliers. However, their unique selling proposition cannot be communicated properly to the consumers, due to the European *health claims regulation*. There are significant market-related and regulatory boundaries, making it hard to launch and establish these products, especially on the German market.

This study aims to provide knowledge and new opportunities to this matter, by examining several factors, in addition to health benefits, which influence adoption or resistance of new product innovations in the field of functional food among German consumers. To this end, findings in adoption and resistance literature, as well as in functional food acceptance, are aggregated to propose factors, as well as to propose a conceptual model integrating the research streams into a single framework.

A review of related literature reveals the relevance of innovation characteristics and adoption barriers in the context of functional food innovations. This study accounts for innovation adoption being a process, distinguishing by the two separate dependent variables adoption intention and adoption behavior.

To be able to test the relationship with multiple linear regression, primary data was collected by means of an online-survey given to consumers on the German market (N = 316). Next to the testing of factors in a general manner, a case experiment is included, using a particular functional food product invention, to complement the findings. 183 participants stated the intention to adopt this presented product, of which 67 bought it directly through the survey, thereby showing adoption behavior.

Drawing from the results of this study, it can be said that there is a positive influence on the innovation adoption of a new functional product if it is perceived as having a *relative advantage* due to *health benefits*, as well as being triable before purchase and compatible with the consumers' personal values. On the other hand, a perceived unfavorable price-to-value relation, bad taste, and distrust towards the claims made by the suppliers, might impede the decision to adopt the innovation. A barrier resulting from habit change and *physical risk* has been shown not to be a significant predictor of the behavior and intention to adopt.

The results suggest that even in health claims regulated markets, there might be a good chance for suppliers to successfully realize adoption of their new product innovation, by focusing efforts on these influential factors, next to health benefits. Most notable for research in the field might be the importance of *trialability* for the consumers, as well as the fact that the extent of the effects differs for almost all factors amongst the two stages of innovation adoption.

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Index of Abbreviations

BRT – Behavioural Reasoning Theory
DOI – Diffusion of Innovation
EFSA – European Food Safety Authority
FMCG – Fast Moving Consumer Goods
TAM – Technology Acceptance Model
TPB – Theory of Planned Behaviour
TRA – Theory of Reasoned Action
UTAUT – Unified Theory of Acceptance and Use of Technology

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1 Introduction

1.1 Product Innovation Adoption and Resistance

Innovations are the main driver of economics in general, as well as of an individual company's growth (Zahra & Covin, 1994, p. 183). A company nowadays cannot avoid being innovative and steadily adjusting to fast changing markets and consumer needs, if it wants to sustain itself long term. Companies must innovate in order to stay competitive over time, or to open up new markets. There are a lot of examples of companies dropping out of the market, because of their unwillingness or inability to innovate (e.g. Eastman Kodak Company, Toys 'R' us, Blockbuster Inc.).
New products not only have to be invented and created, they must be spread and established on the market through adoption and diffusion processes before they can become successful innovations. Innovating can be a highly risky endeavor, due to an often very high amount of required resources, as well as uncertainty as to whether the innovation can be established on the market at all and return the investment. In fact, more than 50% of new products fail (Andrew & Sirkin, 2003).
Therefore, "understanding whether and why consumers will adopt innovations is critical for firms developing and marketing new products and services" (Claudy, Garcia, & O'Driscoll, 2015).
Despite their importance, a lot remains to be unknown about the factors that lead to successful adoption of newly created products by customers. The current research aims at exploring such factors in the field of functional food product innovations.

In business practice, companies desperately engage in market research, analyzing their customers, target groups, and segments, in hopes of getting some understanding of why a product might be bought. "In business practice, managers frequently draw on market research of consumers perception of product characteristics or attitudes" (Claudy et al., 2015). This makes the **buying-decision-process** a central research topic in marketing and market research.

Research on innovation adoption can be considered a special variant of the buying-decision-process, namely one for newly invented products. This goes to show that adoption is an interplay between many domains of science, such as economics and behavioral science.

Research in the field of consumer adoption is mainly based on the "**diffusion of innovation theory**" (DOI) by Rogers (1962), which looked at the general variables of adoption and diffusion of innovations and was not limited to certain fields or types of innovation. Subsequently, a lot of new **innovation adoption models** have been developed, which have integrated parts of Roger's Theory of Diffusion.

In contrast to the DOI being a process-oriented model, further studies mainly applied a result-oriented approach, dealing with certain **factors** that lead to adoption of an innovation, especially perceived characteristics of the innovation itself and/or personal characteristics and mental influences of the consumer.

The research in this field is not only a topic of business and economics, but also highly influenced by psychology and behavioral research. In addition, it can be noted that most of the recent leading models were developed and used especially for the purpose of testing individual acceptance of IT and technology, while the basic theory of Rogers (1962) was not limited to a certain category of innovation. In Business practice, there is a lot of interest in innovation adoption behavior in every economic sector.

Nevertheless, **research on the adoption of food innovations is scarce,** which is why there is a call for more investigation into this topic by leading researchers in the field (Stewart-Knox & Mitchell, 2003, p. 58). This current study focuses explicitly on product innovations in the field of fast moving consumer goods (FMCG), with a focus on **functional food products**, which are categorized as food products with additional nutritional and physiological effects. This study thereby contributes to filling this gap in the literature, gives deeper understanding into a less explored part of adoption research, and aims to provide valuable insight for further investigations, as well as business practices.

Another case worth investigating is the finding that origin of consumers and the country of market one is looking at plays a role in functional food acceptance (Siegrist, Shi, Giusto, & Hartmann, 2015). As pointed out by Michael Siegrist, one of the leading researchers on functional food acceptance, "results suggest the difficulty to launch functional food products for the mass market in Germany" (Siegrist et al., 2015, p. 91), making functional food adoption among German customers a special case worthy of further study. The empirical part of this study specifically concentrates on **German consumers** and tries to tackle this issue from a different perspective.

Consumers might be risk-averse when it comes to novel food. There is a psychological barrier resulting from the notion that products they take directly into their body can potentially harm their health. A phenomenon called "*food neophobia*" has even been studied, which is a general apprehension to trying new food products (Pliner & Hobden, 1992; Siegrist, 2008; Siegrist, Hartmann, & Keller, 2013; Trijp, Kleef, van Trijp, & van Kleef, 2008; Urala & Lähteenmäki, 2003).
It is therefore proposed that it is essential to look at potential barriers when looking at food innovation adoption, too.

This proposition corresponds with a downfall of traditional adoption models and the diffusion of innovation theory, which are widely regarded as "neglecting factors that lead to **consumer resistance of innovations**" (Claudy et al., 2015, p. 528), by several researchers (Claudy et al., 2015; Garcia, Bardhi, & Friedrich, 2007; Kleijnen, Lee, & Wetzels, 2009; Ram & Sheth, 1989). Considering the generally high failure rate of innovations, which can be estimated across all product categories to be between 40% to 90% (Gourville, 2006, p. 98), studies suggest that factors that cause resistance of innovations should be considered, rather than those related to successful adoption (Antioco & Kleijnen, 2010; Claudy et al., 2015).

To account for the existence of potential barriers that consumers may perceive, resulting in the resistance to an innovation, a body of literature covering innovation resistance has begun to form, parallel to innovation adoption literature.
For a long time, the adoption and resistance streams were separated from one another in the literature, apart from the knowledge that consumers' reasons for accepting or resisting an innovation have a significant influence on innovation adoption.

An attempt to combine both approaches was made just recently by Claudy et al. (2015), suggesting the application of another behavioral model, introduced by Westaby (2005) – the *behavioral reasoning theory* (BRT). The goal was to be able to "test the relative influence of both reasons for and reasons against adoption" (Claudy et al., 2015, p. 528) in a single framework.

In the empirical part of this study, the notion of BRT has been adopted and simplified, as well as applied and adjusted to especially examine the factors behind adopting or resisting product innovations in the functional food sector among German customers.

This study aims to contribute to the scientific discourse of this matter by further testing the application of concepts from adoption and resistance studies in a single framework, as well as contributing to further understanding in the particular field of acceptance of new functional food product innovations among German customers.

1.2 Problem Context Functional Food Innovations

"To gain success in the growing functional food market, manufacturers should know more about the reasons behind why the consumer chooses functional food."

- Urala & Lähteenmäki (2003, p. 148)

Launching a functional food product innovation today is known to be an extremely risky endeavor, due to the cost of introducing such products into the market, combined with their low success rate. New functional food products are frequently launched (Bigliardi & Galati, 2013), but it is very difficult to predict, even for food professionals, which ideas will gain popularity (Van Kleef, Van Trijp, Luning, & Jongen, 2002).

When mass-marketing a food product, it has been almost impossible in the past to avoid retail markets, since they account for almost all food sales. Even nowadays in the U.S., only 4,3% of the total food and beverage sales were made online in 2016, although big players such as Amazon were aggressively engaged in the market already (Daniels, 2017). Given the scarcity of retail spaces in stationary food stores, it is unsurprising that competition between food product suppliers is exceptionally high. This applies not only to actual sales of the products (competition between retailers), but especially to the struggle amongst food product suppliers to gain access to retail space in the first place (Winger & Wall, 2006). Innovators of food products in today's markets will find it very difficult to get their merchandise listed with traditional, stationary retailers. Vendors face limitations in terms of available retail space, stocking primarily the established brands.

As illustrated in the numbers, only 10% of all newly developed food products that are offered to U.S. supermarkets will be selected for sale off of the shelves. 12.000 up to 40.000 retail spaces for food and beverages are typically available in an American supermarket, with 18.000 new products trying to make their way onto the shelves each year. A new food product that does make it there, still has only a 1% chance of still being there after 5 years (Winger & Wall, 2006, p. 6). Customers in physical stores also do not tend to be searching for unfamiliar, innovative products, with 72% of them indicating that they would always or often purchase the same products every time when they go to buy groceries (Winger & Wall, 2006, p. 6).

Beside obstacles on the market through the competitive landscape, additional barriers can be found in regulatory nature (Kwak & Jukes, 2001).

To a large extend, functional foods are developed in a way where a conventional food product is taken as a carrier (such as juice or yogurt) and has a special health benefit added, by enriching the product with vitamins, minerals, micronutrients, antioxidants, probiotics, plant extracts and the like. Therefore, central to the concept of functional foods are their added health benefits, compared to their conventional food equivalent.

In December 2006, the *Regulation (EC) No. 1924/2006* of the European Parliament and European Council on nutrition and health claims made on foods, commonly known as *health claims regulation*, was established. A health claim can be understood as any statement about a relationship between food and health (EFSA, 2011). According to the regulation, it is generally forbidden to make any nutritional or health related claim for food products, apart from a given list of authorized health claims that are permitted to use under strict restrictions and in special conditions. To date, this list

only contains a few permitted claims, and only for certain vitamins and minerals. For other effective substances like probiotics, fiber and especially botanical substances such as plant extracts, polyphenols and the like, the allowed claims are still missing. This is why food producers currently artificially add vitamins and minerals that are not necessary or even beneficial for the product or user, but only for the purpose of being able to make claims.

From another point of view, it is at least debatable whether the *health claims regulation* is reasonable at all. For example, a wide range of products contain ascorbic acid[1] as a preservative, unintentionally allowing producers to use the health claims.[2] In this regard, the *health claims regulation* has been criticized for not providing a good guideline to the consumer.

From an economic perspective, as a result of the *health claims regulation*, the possibilities for companies communicating their functional food products to consumers have been massively reduced. This creates a particularly difficult situation, as claiming the benefits of the product has been found to be crucial, since effects of functional foods can rarely be experienced directly. This circumstance is hard for all functional food products on the market, but disproportionally higher for new products entering the market.

On one hand, functional food products established on the market before 2006 could already communicate their benefits with a fully available range of claims, before they had to cut them down in accordance with the health claims regulation, giving them an additional advantage. It is likely that consumers remember the once communicated health benefits of those products to a high extent.

On the other hand, functional food product innovations can only make use of a small range of allowed claims to launch and communicate the innovation amongst customers. It is likely that an innovation will hardly be adopted by consumers, if its main product characteristics cannot be communicated clearly by the providing company.

Altogether, this makes it increasingly important to look at a wider range of different factors that might have an influence on consumers' willingness to adopt functional food product innovations, apart from the obvious, and traditionally used ones.

All these earlier points underline the challenge of successfully launching a new innovative food product on the market. Vast retail spaces and expensive retail listings, combined with the unpredictable amount of success that a new innovative food product will have with consumers, and the regulatory impediments.

Although it became harder to successfully launch innovations in the functional food sector, companies cannot afford to stop innovating, simply relying on old product concepts. Therefore, understanding motivations and drivers behind the food product choices of consumers is crucially important for any food innovation company (Loizou, Michailidis, & Tzimitra-Kalogianni, 2009, p. 3).

In general, there is a gap in the literature when it comes to adoption studies in the field of functional food innovations. Only a few researchers have looked at this special topic of fast moving consumer goods so far. With the implementation of the recent health claims regulation in the European Union,

[1] More commonly known as: vitamin C.

[2] For example, usually just used as preservative for sausages, these sausages can be labelled because of the contained vitamin C as: it supports function of the immune system, nervous system, cognitive function, energy metabolism.

circumstances have changed dramatically for companies releasing functional food product innovations, making it difficult to apply former research results, as well as results conducted outside the European Union. Rather, it is necessary to re-investigate this special topic under the current market conditions. Companies cannot rely on communicating health benefits anymore, which is why this study investigates a wider range of adoption and resistance factors. Compared to other studies in the field, which looked solely at either adoption or resistance factors, this study combines both research streams into a single conceptual framework. Furthermore, previous studies commonly looked at innovation adoption as the only dependent variable, proposing that it is a good estimator for actual adoption behavior. Since recent studies have shown the opposite, and an often fairly weak relation between intention and adoption in business practice has been found, the current study makes a distinction between adoption intention and behavior as dependent variables, taking this issue into account.

1.3 Research Question and Goal of the Study

Derived from the prior argumentations, the aim of this research is:

to examine the factors influencing adoption or resistance of new product innovations in the field of functional food, among German consumers.

The objectives to be covered to address this aim are:

- Aggregating the findings of adoption and resistance literature to propose a conceptual model, integrating both research streams into a single framework.
- Reviewing of literature on the relevant adoption and resistance factors in the context of functional food innovation.
- Testing the model by means of a survey concerning the general attitude towards functional food product innovations, as well as a case experiment of a new functional food invention made by the project partner *Neuronade.*
- Accounting for innovation adoption being a process by making a distinction between adoption intention and adoption behavior as explained variables.
- Identifying indicators for companies which factors they have to address carefully when launching functional food product innovations on the German market.

Resulting from this, the following research question is formed to address the aim and objectives:

Which factors influence the innovation adoption of functional food product innovations among German consumers?

2 Theoretical Framework

2.1 Definition of Functional Food

The most precise definition of functional food has been provided by Diplock et al. (1999): “A food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either improved stage of health and well-being and/or reduction of risk of disease. A functional food must remain food and it must demonstrate its effects in amounts that can normally be expected to be consumed in the diet: it is not a pill or a capsule, but part of the normal food pattern.” (Diplock, A. T., Aggett, P. J., Ashwell, M., Bornet, F., Fern, E. B. & Roberfroid, 1999, p. 6).

To put it in other words, functional foods are food products that come in a special form, in terms of having additional physiological effects on the body. These effects are just for nutritional and nutrient providing purpose, which clearly separates these from disease-healing medical and pharmaceutical products. Functional foods regularly “promise improved health, better well-being, or enhanced functioning of physiological processes” (Siegrist et al., 2015, p. 88). Examples of functional foods range from fortified foods, like juices with additional vitamins, enriched foods with added nutrients not usually found in the food, like margarine with added probiotics or eggs with added omega-3, altered foods where a containing substance has been removed, reduced or changed, like gluten replaced with fiber in bread, up to dietary supplements (Siró, Kápolna, Kápolna, & Lugasi, 2008, p. 459; Spence, 2006, p. S5).

2.2 Definition of Innovation

Although innovation is a commonly known term, its definition is rather complex and varies a lot within the literature among different fields. There is no single correct definition of innovation, and it can have different meanings in different contexts.

For example, attempts have been made to combine 60 definitions of organizational innovation derived from various business and organization related fields, leading to: “Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.” (Baregheh, Rowley, & Sambrook, 2009, p. 1334).

A central definition in practice is the one proposed by the OECD (2005) which was meant as a guideline for collecting and interpreting innovation data as a measurement of scientific and technological activities. According to this, an innovation is “the implementation of a new or significantly improved product (goods or services), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.” (OECD, 2005, p. 46).

Innovations therefore can be classified as, and differentiated into product, process, marketing and organizational innovations.

Product innovation	The implementation of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
Process innovation	The implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
Marketing innovation	The implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
Organizational Innovation	The implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

Table 1: Classification of Innovations by type according to OECD (2005, pp. 46-56).

Furthermore, as defined, every innovation has a certain degree of novelty. An innovation therefore can be either new to the firm, new to the market, or new to the world (OECD, 2005, pp. 57–58).

New to the firm	Innovation may already be introduced by other companies, but it is an innovation for that company.
New to the market	The company is the first to introduce the innovation on its market.
New to the world	The company is the first to introduce the innovation for all markets and industries internationally.

Table 2: Classification of Innovations by degree of novelty according to OECD (2005, pp. 57-58).

According to the aforementioned definitions, innovations can be distinguished from invention in that innovations are not only something new, but consumers are aware of it, there is commercial success, and the invention is implemented on the market. "A discovery that goes no further than the laboratory remains an invention'' (Garcia & Calantone, 2002, p. 112).

Another distinction can be made by novelty and impact of the innovation. Thus, innovations can be *incremental* or *radical*[3]. Radical innovation describes a small amount of innovations, that are truly new to the world and disrupt markets. In contrast, incremental innovation "involve improvements, additions to existing lines and product lines that are new to the company but not necessarily to the

[3] Synonym for term *radical innovations* is *discontinuous innovations*. *Disruptive innovation* has a similar notion, but is strongly related to the research of Clayton Christensen (see J. L. Bower & Christensen, 1995).

market" (Grunert & van Trijp, 2014, p. 377). Most innovations are incremental, which applies also to the context of food innovations (Grunert & van Trijp, 2014, p. 377).

For the purpose of this study regarding adoption through innovation characteristics, the definition by Rogers (2003) is used, according to which innovation is "an idea, practice or object perceived as new by the individual" (Rogers, 2003, p. 12). Central to this definition is the perception of the customer, which determines whether a product is new and can be considered an innovation.

2.3 Distinction between Adoption and Diffusion

Both adoption and diffusion have the acceptance of innovations as their main research object, which might be the reason why the terms are sometimes used interchangeably, although they can be distinct from each other (Staufer, 2015).

The Theory of Diffusion is defined by Rogers (2003) in his book *Diffusion of Innovation*, first published in 1962, as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 11). Diffusion therefore approaches the acceptance of innovations from a macroeconomic level, looking at the process of spreading innovations on the market over time. The cumulated adoption decisions over time can ideally be displayed in a s-shaped curve, as illustrated in Figure 1. This originates from the fact that not all consumers on the market adopt an innovation at the same time, but gradually decide on purchasing the innovation according to their individual preferences and characteristics.

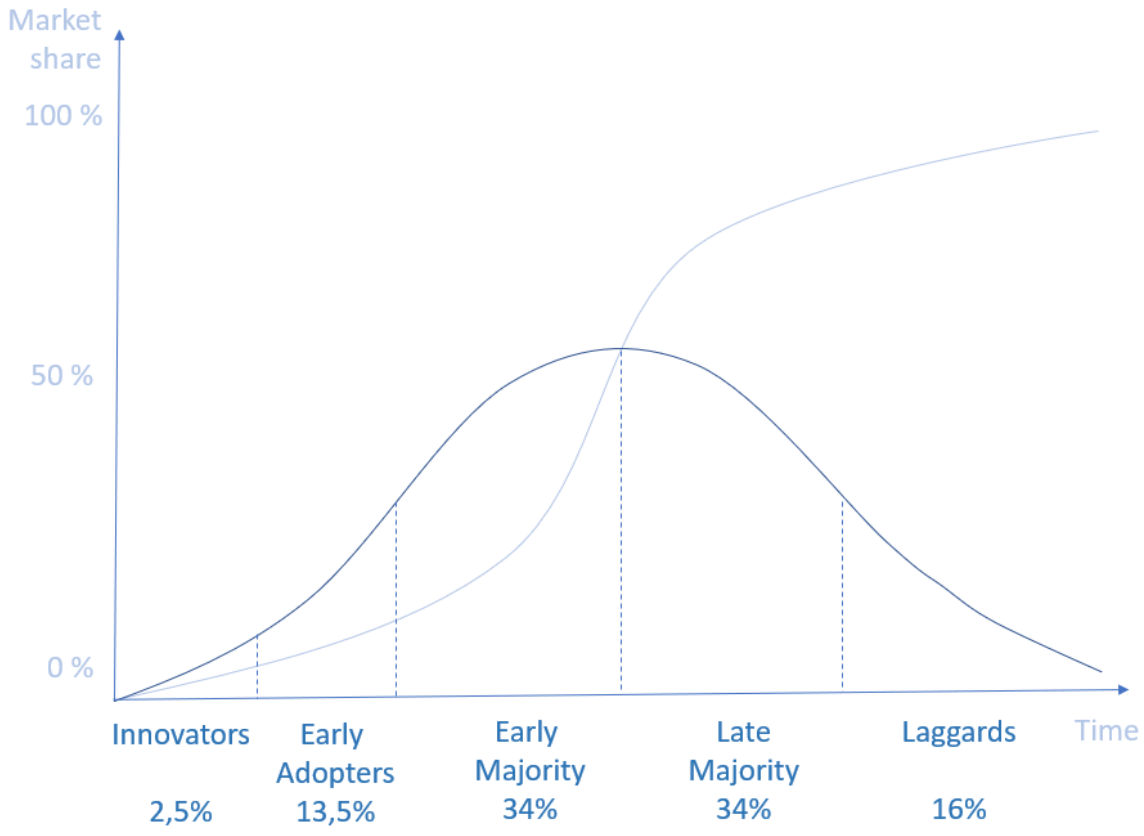

Figure 1: Adoption over time and different adopter categories. Adapted from Rogers (1995).

This is closely related to the classification of consumers into different adopter categories, which are "the classifications of the members of a social system on the basis of innovativeness" (Rogers, 2003, p. 22). Depending on their innovativeness, which is "the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system" (Rogers, 2003, p. 22), adopters can be categorized into: *innovators*, *early adopters*, *early majority*, *late majority*, and *laggards*. Adopters are normally distributed as shown in Figure 1. The different types of adopters not only differ in their degree of innovativeness, but also considerably in their socioeconomic status, personality variables, and communication behavior (Rogers, 2003).

In contrast to the macro-level view of *diffusion*, *adoption* looks at the decision process of accepting an innovation by an individual, looking at the micro-level (Staufer, 2015).

Nevertheless, the majority of research and models of adoption originate from the *Theory of Diffusion*, as well. As defined by Rogers (2003): "adoption is a decision to make full use of an innovation as the best course of action available" (Rogers, 2003, p. 177). An individuals' adoption is also inherent in the diffusion of innovation as described in the theory of Rogers (1962) with its *innovation-decision-process*, from which the majority of research and models of adoption originate. Rogers (2003) defines the innovation-decision-process as "the process through which an individual [...] passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or resist, to implementation of the new idea, and to confirmation of this decision" (Rogers, 2003, p. 168). The innovation-decision-process consists of several stages of awareness of a product or innovation that a consumer goes through, which are displayed in Figure 2.

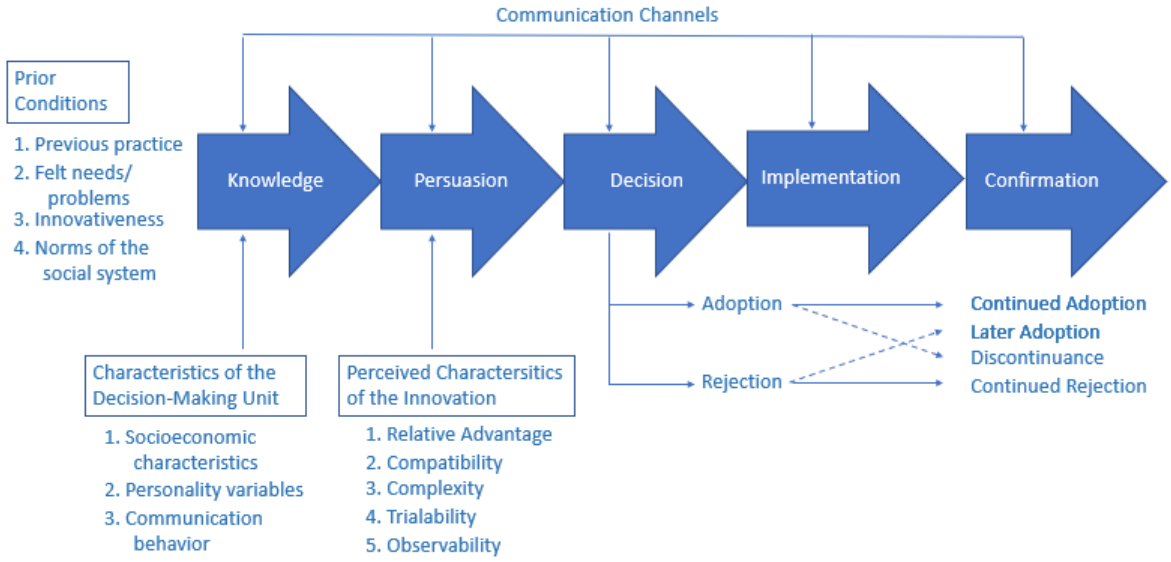

Figure 2: Model of five stages in the innovation decision process. Adapted from Rogers (2003).

The process is divided into 5 stages, beginning with initial *knowledge* about the product's existence, and its use or function. Various factors, such as behavioural or communicational patterns, or socio-economic status, can have a direct impact on the likelihood of a consumer entering this stage of the process.

However, the Diffusion of Innovation theory not only concerns the characteristics of individual adopters, but also the characteristics of the innovations itself. Once an initial understanding is gained, the *persuasion* phase sets in, during which a consumer becomes relatively convinced of either the usefulness of the product, or lack thereof. In other words, a positive or negative opinion about the innovation is formed. The outcome of this phase is, according to Rogers (2003), largely determined by what are referred to as *perceived characteristics of the innovation*: *relative advantage, compatibility, complexity, trialability,* and *observability*. Through this assessment, consumers form an attitude towards the innovation, which is either favourable or unfavourable and results in a certain intention to adopt it. The following *decision* stage represents the period of time during which a consumer will actually decide to adopt or resist the innovation. Once a consumer has acquired and starts using the innovation, the *implementation* stage has begun. After assessing the innovation, the *confirmation* phase starts, in which the consumer decides either to adopt and use the innovation long-term or reject it subsequently.

2.4 Categorization of Adoption Models

In general, the research on adoption can be categorized in two approaches:

1) the process-oriented approach, where most noted examples are the formerly mentioned innovation-decision-process by Rogers (1962) as well as the hierarchy of effects model by Gatignon & Robertson (1985), describing the adoption decision as a process requiring several steps, and
2) the result-oriented approach, which builds the actual core of adoption research (Staufer, 2015). It mainly focusses on the evaluation and decision stages where certain factors, that influence the likelihood of adoption by consumers, are analysed (Claudy et al., 2015).

Because research has most widely applied the result-oriented approach, the further explanations take a more detailed look at this approach.

Research utilizing the result-oriented approach mainly looks at certain factors that lead to the decision in favour of, or against adopting the innovation. “These individual adoption decisions are influenced by personal characteristics, perceived innovation characteristics, personal influence, and marketing and competitive actions” (Gatignon & Robertson, 1985, p. 850), whereas the first three are mostly applied in adoption literature and the latter two in marketing science. Throughout innovation adoption literature, adopters’ personal characteristics and perceived characteristics of the innovation are identified as the main factors for innovation adoption (see Arts, Frambach, & Bijmolt, 2011; Gatignon & Robertson, 1985; Rogers, 2003; Tornatzky & Klein, 1982).

Perceived Product Characteristics of the Innovation:

Concerning innovations, „in order for consumers to make an adoption decision they evaluate information about its characteristics” (Flight, D’Souza, & Allaway, 2011, p. 343). The most widely used innovation characteristics are those introduced by Rogers (1962): *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*, which are, according to Rogers (2003, p. 221), likely to “explain 49-87% of variation in adoption rates” (Claudy, Michelsen, & O’Driscoll, 2011, p. 1462). In the frequently used *technology acceptance model*, *relative advantage* has been renamed

to *perceived benefit* and *complexity* is called *perceived ease of use* (Davis, 1989; Grunert & van Trijp, 2014). Definitions of the perceived innovation characteristics can be found in Table 3. Innovation characteristics have found to be important drivers for adoption intention as well as

Personal characteristics and personal influence:

Furthermore, there are factors that relate to the personal characteristics and traits of the consumer and their influence on the adoption decision. There is a multitude of those consumer related factors influencing adoption, including socio-demographic characteristics like age, gender, educational level, and income, but also psychographic factors, such as personality, preferences, attitudes, expectations, beliefs, involvement, opinion leadership and innovativeness. There is a tendency in literature to focus on the perceived characteristics of the innovation itself, but behavioural and personal traits of the consumers are seen as influential factors on the individual's adoption decision as well (Arts et al., 2011; Staufer, 2015)

2.5 Consumer Innovation Adoption Models

A considerable body of literature has been engaged in *innovation characteristics research*, which describes "the relationship between the attributes or characteristics of an innovation and the adoption or implementation of that innovation" (Tornatzky & Klein, 1982, p. 28), which Rogers' (1962) innovation characteristics have been central to.

Over time, various related and extended models resulted from it, which innovation adoption researchers have mainly used or adapted the *theory of reasoned action* (*TRA*) by Fishbein & Ajzen (1975) and the *technology acceptance model* (*TAM*) by Davis (1989) to examine the influence of perceived product characteristics on consumers' adoption decisions (Claudy et al., 2015). For the *TRA* model, central concepts are *beliefs* and *attitude*, whereas *beliefs* have been defined as "a person's subjective probability judgement concerning some discriminable aspect of his world" (Fishbein & Ajzen, 1975, p. 131). Subsequently, the *TRA* has been extended by Ajzen (1985) to the *theory of planned behavior* (*TPB*), suggesting that *attitude toward behavior*, *subjective norms* and *perceived behavioral control*, influence an individuals' *behavioral intention* and *behavior*. The conceptual models of *TRA* and *TPB* are shown in Figure 3. Both models have been applied to diverse product and service categories.

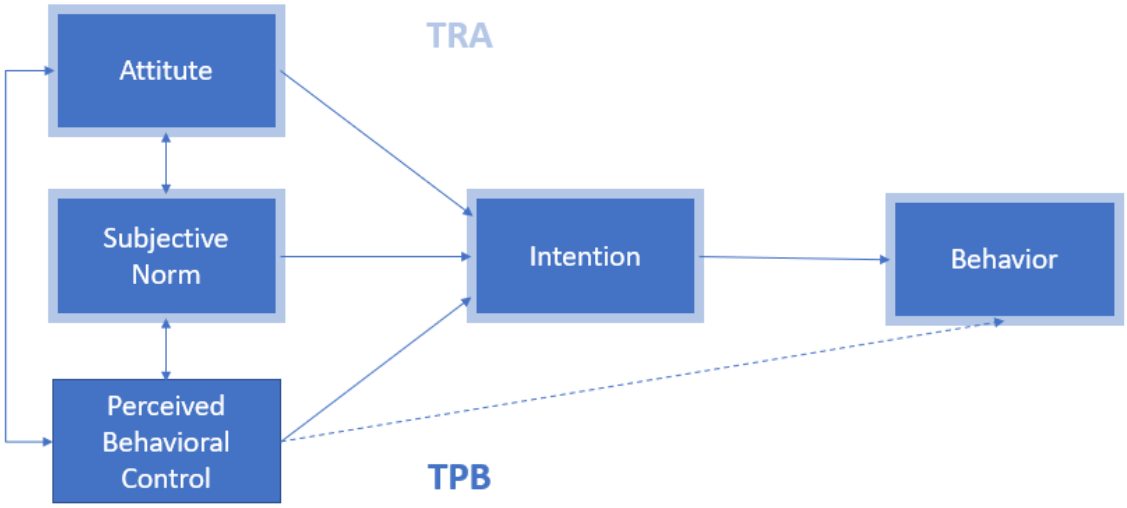

Figure 3: TRA displayed in light blue, TPB displayed in dark blue. Adapted from (Ajzen, 2006).

To investigate in particular the acceptance of innovations in the upcoming field of information technology and on software usage, the *TRA* has been adapted by Davis (1989) to propose the *technology acceptance model* (*TAM*). In the *TAM*, two of the perceived innovation characteristics - *relative advantage* and *complexity* - have been integrated and transformed to *perceived usefulness* and *perceived ease of use* (Grunert & van Trijp, 2014; Venkatesh, Morris, Davis, & Davis, 2003). These coherences are displayed in Figure 4.

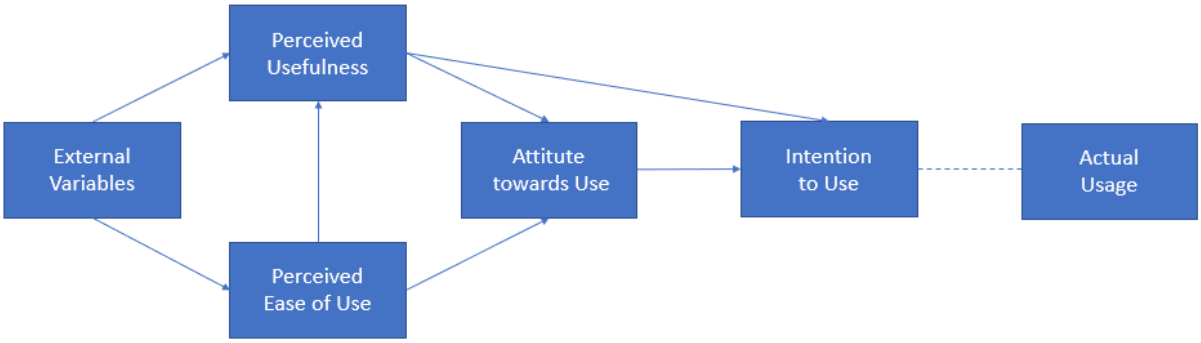

Figure 4: Technology acceptance model (Davis, 1989).

The presented models postulate, that consumers perceptions of characteristics of innovations lead to the forming of attitudes towards them, which consequently influence adoption intention, which influences adoption behavior. For some variables, as for *perceived usefulness*, a direct influence on *intention to use* can be found, as well.

2.6 Consumer Innovation Resistance Models

"Innovation mean change to consumers, and resistance to change is a normal consumer response that has to be overcome before adoption may begin"

– (Laukkanen, Sinkkonen, Kivijärvi, & Laukkanen, 2007, p. 420)

A problem of the previously presented adoption models is, that they only include the positive views on innovation, mostly leaving out certain barriers to acceptance. This is particularly problematic, since consumers' resistance to buy or use a product may account to a large extend for the failure of product innovations (Heidenreich & Kraemer, 2016). Rogers (1976) already identified and examined this as a "pro-innovation bias which assumes that all innovation is desirable" (Gatignon & Robertson, 1985, p. 849) as one of 3 biases in diffusion research. New and innovative products are beyond question appealing to most consumers, yet "customers face several barriers that paralyze their desire to adopt innovations." (Ram & Sheth, 1989, p. 11). "For example, consumers may see the relative advantage of an innovation, like with electric vehicles, and report a positive attitude toward it. Yet they may still resist it because of (perceived image or) cost barriers" (Claudy et al., 2015, p. 528).

Studies support the fact that the reasons for resistance to innovation are not necessarily the mere opposites of why people would adopt an innovation, making it a topic worth studying (Garcia et al., 2007; Kleijnen et al., 2009). A simple example that is used to demonstrate this is the adoption of an electric vehicle: consumers might adopt this innovative product because of the perceived relative advantage over fueled vehicles, that using it is better for the environment, but it's hardly probable that they resist this innovation because they want to harm the environment (Chatzidakis & Lee, 2013, p. 196; Claudy et al., 2015, p. 529).

To account for this phenomenon, an innovation resistance literature has evolved, parallel to the research on innovation adoption.

Firstly, researchers included a construct named *perceived risk* to the adoption studies, thereby expanding Rogers' five perceived product characteristics. Bauer (1967) introduced this concept in behavioral research (Robert N. Stone & Kjell Grønhaug, 1993), where it has been picked up and over the time become a "well-established concept in innovation literature" (Claudy et al., 2011, p. 1462).

A separate body of literature has since developed concerning innovation resistance, originating from the studies of Ram (1987) and Ram & Sheth (1989). In their study, (Ram & Sheth, 1989) had pointed out that *functional barriers* can be found, namely the *usage barrier, value barrier* and *risk barrier*, as well as *psychological barriers*, namely the *tradition barrier* and *image barrier*.

Kleijnen et al. (2009) merged the existing literature up to that point in time, proposed a conceptual framework including the major resistance factors, and formulated a model of consumer resistance which builds mainly on the concepts of Ram & Sheth (1989).

2.7 Overview Innovation Adoption and Resistance Factors

Adoption factors	Definition
Innovation Attributes	
Relative Advantage	Degree to which an innovation is perceived as being better than the idea/product it supersedes
Compatibility	Degree to which an innovation is perceived as consistent with existing values, past experiences, life styles and needs of potential adopters
Complexity	Degree to which an innovation is perceived as relatively difficult to understand and use
Trialability	Degree to which an innovation may be experimented with on a limited basis
Observability	Degree to which the results of an innovation are visible to others (Rogers, 1962)
Perceived Usefulness	Degree to which using a particular system would enhance job performance
Perceived Ease of Use	Degree to which using a particular system would be free from effort (Davis, 1989)
Resistance factors	Definition
Functional Barriers	
Usage Barriers	Degree to which an innovation is perceived as requiring changes in consumers' routines (Ram & Sheth, 1989)
Value Barriers	Degree to which an innovations' value-to-price ratio is perceived in relation to other product substitutes (e.g., Molesworth & Suortti, 2002)
Risk Barriers Financial Performance Social	Degree of uncertainty in regard to financial, functional and social consequences of using an innovation (e.g., Herzenstein, Posavac, & Brakus, 2007)
Psychological Barriers	
Tradition and Norm Barriers	Degree to which an innovation forces consumers to accept cultural changes (Herbig & Day, 1992)
Image Barriers	Degree to which an innovation is perceived as having an unfavorable image (e.g., Ram & Sheth, 1989)

Table 3: Overview of adoption and resistance factors. Adapted from Claudy et al. (2015).

2.8 Combining Adoption and Resistance Models - Behavioral Reasoning Theory

An important notion that enters the adoption research is that resistance factors are not just the opposites to adoption factors (Chatzidakis & Lee, 2013; Claudy et al., 2015).

Lately, there has been a call for combining adoption and resistance factors in empirical research, to account for "dichotomous nature" of adoptions (Claudy et al., 2015, p. 532).

For that purpose, first efforts have been made recently to apply the *behavioral reasoning theory* (*BRT*) from social psychology to adoption research (Claudy et al., 2015; Claudy, Peterson, & O'Driscoll, 2013). *BRT* was developed as a result of social psychology facing a similar notion that consumers judge reasons for, and reasons against simultaneously when engaging in behavior or

planning behavioral intention (Claudy et al., 2015; Westaby, 2005; Westaby, Probst, & Lee, 2010). Whether the *BRT* model will be widely accepted in adoption research remains to be seen.

Nevertheless, it is proposed that future adoption research will primarily focus on integrating adoption and resistance factors in single frameworks, to account for reported shortcomings in previously applied models.

Compared to *BRT*, the current study employs a simplified model, investigating the direct influence of several adoption and resistance factors on adoption intention. As evidenced in the theoretical discourse, previous research has shown, that a direct influence of perceived innovation characteristics, adoption barriers, as well as reasons for and against the adoption, on adoption intention and behavior can be assumed (see Arts, Frambach, & Bijmolt, 2011; Claudy et al., 2015; Flight et al., 2011; Tornatzky & Klein, 1982). These coherences are applied to the special context of functional food product innovations.

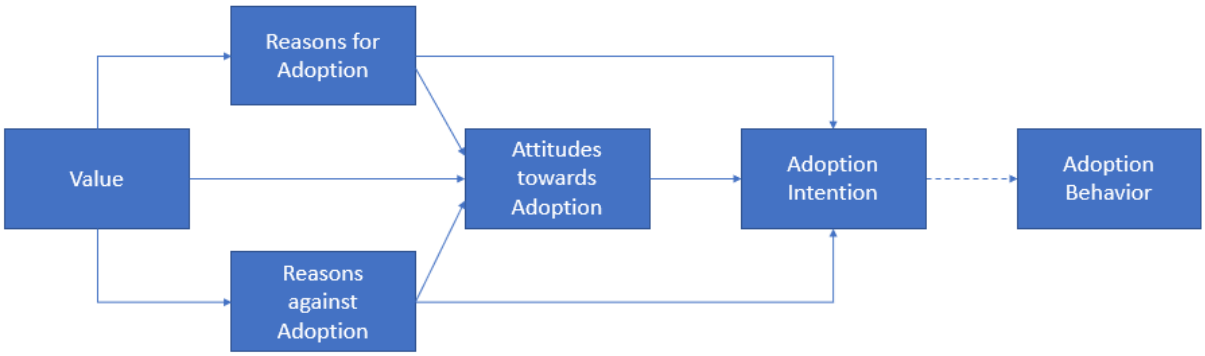

Figure 5: Behavioral Reasoning Theory (Westaby, 2005) *as adapted by* Claudy et al. (2015).

2.9 Forming of Hypothesis and Framework

As stated above, consumer assessment of the perceived product characteristics is likely to determine their propensity to adopt. The most widely used perceived product characteristics are *relative advantage*, *compatibility*, *complexity, trialability*, and *observability* as introduced by Rogers (1962). According to Grunert & van Trijp (2014), the perceived product characteristics are "highly relevant to the acceptance of new food products" (Grunert & van Trijp, 2014, p. 384).

On the other side, the most frequently used factors for resistance of product innovations[4] are *usage barrier*, *value barrier*, *risk barrier*, *tradition barrier*, and *image barrier* as introduced by Ram & Sheth (1989).

First, the main factors for adopting and resisting innovations are examined according to applicability of the studies to the special context of function food product innovation. An overview is shown in table 4. The most applicable factors are shaded in green, relevant contexts and studies are stated,

[4] Also put as barriers to adoption or reasons against adoption.

which are then followed by in more detailed explanations in the next section. The less context-relevant factors are shaded in red, there is short argumentation as to why they have been excluded from the hypothesis for this study.

Adoption Factors	Relative Advantage	Seen as the main driver for functional food adoption in many previous studies. Found in different forms: *health benefit*, *perceived benefits* (Siegrist, 2008), *perceived healthiness* (Urala & Lähteenmäki, 2003), *taste* (Urala & Lähteenmäki, 2003; Verbeke, 2005), *naturalness* (Siegrist, 2008)
	Compatibility	Innovation being compatible with the consumer's existing values, past experiences and needs. Focus on *personal compatibility*, *health motivation* (Renner, Sproesser, Strohbach, & Schupp, 2012; Siegrist et al., 2015), and *health benefit beliefs* (Childs, 1997; Verbeke, 2005)
	Complexity	Partly covered by *usage barrier*, hard to distinguish clearly. Even in adoption studies a negatively coded item, which reflects more a barrier than a reason for adoption (Arts et al., 2011, p. 141). Refers to how easy it is to understand and use the innovation. Functional foods are rarely high-involvement products that would require significant cognitive efforts or learning costs of the consumer. While they are mostly easy to use, they require changes in existing habits, which are covered more precisely under *usage barrier.*
	Trialability	Often applied in business practice: food samples given as a free trial before purchase or trialability at a booth. Could not be found in literature on functional food product innovation adoption yet.
	Observability	It is hard to ensure that results are noticeable by others with functional food, since effects might be only noticeable by the user themselves. Furthermore, functional food is often consumed in private spaces and usually hard to distinguish from conventional food based on its appearance.
	Perceived Usefulness	Has been developed specifically for studies about the adoption of IT, will be tested using *relative advantage*
	Perceived Ease of use	Has been developed specifically for studies about the adoption of IT. Refers to *complexity,* which is described above.
Resistance Factors	Usage Barrier	Change in habit can be necessary to ensure correct intake of the functional food. Habit changes might be hard to implement and unwanted (Kleijnen et al., 2009). Trend for *convenience* (Brunner et al., 2010), passive *habit slips* (Labrecque, Wood, Neal, & Harrington, 2017), and *acceptance in daily routines needed* (Siegrist et al., 2015).
	Value Barrier	Whether an innovations benefit-to-price-relation is convincing, compared to its alternatives (Ram & Sheth, 1989). Price as a barrier to adoption of functional food can be found in several studies (Siegrist et al., 2015; Urala & Lähteenmäki, 2003; Verbeke, 2005). Price issues are also partly covered by *relative advantage* and *risk barrier (economic).* Nevertheless, the *value barrier* is seen as the most appropriate one in the study's context.
	Risk Barrier	Segmented into four types: *functional, economic, social* and *physical risk barriers*. Seen as a main factor against adoption by many previous studies, described in different forms: *perceived risks* (Siegrist, 2008), *safety of functional food* (Urala & Lähteenmäki, 2007), *food neophobia* (Pliner & Hobden, 1992; Siegrist, 2008; Siegrist et al., 2013; Trijp et al., 2008)
	Tradition Barrier	Since functional foods are quite similar to traditional/ conventional food, in the same way that the basis/ carrier often is a known food product, the cultural changes needed to adopt functional foods are proposed to be minor.

		A *tradition barrier* can of course be found for some special food items (Ram & Sheth, 1989, p. 9), but no relevant literature has been found which explicitly describes a *tradition barrier* in functional food adoption.
	Image Barrier	An individual's lack of trust in, clichés or unfavorable perception of the supplying company, industry or brand leading to resistance (Ram & Sheth, 1989). Relevant factor: *trust*. Trust in functional food claims, supplying companies, or the industry as whole as reason against functional food acceptance was described by L. J. Frewer, Howard, Hedderley, & Shepherd (1996); Siegrist (2008); Siegrist et al. (2015); Urala & Lähteenmäki (2003).

Table 4: Relevance of adoption and resistance factors in the field of functional foods.

In conclusion, *relative advantage*, *compatibility*, *trialability*, *usage barrier, value barrier, risk barrier* and *image barrier* have been identified as most suitable for the research context, which is why they are further investigated in the current study.

Relative Advantage

Relative advantage is possibly the most important characteristic of a new product that can be found in various research, since it is seen to most significantly influence the rate of adoption (Flight et al., 2011, p. 345). It describes how much a new innovative product must be better or more useful than the current product on the market it would potentially replace. Relative advantage relates to the degree the consumer will gain benefit from the innovation as perceived by its attributes or qualities (Flight et al., 2011, p. 345). If there is a clear advantage for the consumer compared to the current solution to a problem, it might of course be interesting to the consumer. The exact extent to which the *relative advantage* of the innovation has to be perceived by the consumer, in order to be relevant and cause him to replace the old product with the new solution, still needs to be researched. Some authors suggest that the new innovative product even has to offer benefits that are at least ten times greater than those of existing products (Gourville, 2006, p. 104). *Relative advantage* has also been applied to the *TAM*, where it is a central variable labeled as perceived usefulness, which also has a direct influence on *usage/ adoption intention*.

The central incentive to buy a functional food product and point of differentiation to comparable conventional food products, are the inherent *health benefits* the product claims to offer. The positive effect of perceived *health benefits* as the main driver for choosing certain functional foods, has been described by literature in different forms and by different authors, such as part of *perceived benefits* (L. Frewer, Scholderer, & Lambert, 2003; Ronteltap, van Trijp, Renes, & Frewer, 2007; Siegrist, 2008) or *perceived healthiness* resp. *perceived reward* from using functional foods (Urala & Lähteenmäki, 2004, 2007). It is therefore hypothesized that:

H1a - Perceived health benefits have a positive influence on consumers' innovation adoption of functional food product innovations.

Additionally, classical food patterns seem to be equally important as perceived *health benefits* to the consumers. Although the immanent point of differentiation of functional foods are the additionally proposed *health benefits*, research shows that many consumers might not be willing to compromise on *taste* for *health benefits* in functional foods (Verbeke, 2005).

In general, *taste* is one of the top reason for consumers food choices (Lappalainen, Kearney, & Gibney, 1998), a fact that also applies to functional foods (Lähteenmäki, 2013; Siegrist et al., 2015). In the special case of German consumers, Siegrist et al. (2015) attributed the reduced willingness to buy functional foods to the possible perception of them that added *health benefits* would lead to a less tasty food product. *Taste* might therefore be an important factor for the adoption of innovative functional food products, which is why it is hypothesized that:

H1b - Perceived good taste has a positive influence on consumers' innovation adoption of functional food product innovations.

Compatibility

As describes by Rogers (2003), *compatibility* determines the "degree to which an innovation is perceived as consistent with existing values, needs, and past experiences of potential adopters" (Rogers, 2003, p. 15). So, broadly this construct is divided into *personal compatibility* (innovation is perceived as compatible with personal beliefs and life styles) and *social compatibility* (innovation is perceived as compatible with social norms, social structure and social expectations of the adopter) (Flight et al., 2011).

Personal compatibility has been referred to in functional food literature in different ways. Important determinants are consumers' *familiarity with the concept of functional food* (Siró, Kápolna, Kápolna, & Lugasi, 2008, p. 465), consumers' *opinions on functional foods and healthy eating* and its relationships (Niva, 2007), consumers' *belief in the food-disease prevention concept* (Wrick, 1995), *health motivation* (Renner, Sproesser, Strohbach, & Schupp, 2012; Siegrist et al., 2015), and *health benefit beliefs* (Childs, 1997; Verbeke, 2005).

Most importantly, Siegrist et al. (2015) showed that *health motivation*, meaning consumers' attitude of putting emphasis on health aspects when choosing food, is a factor that positively influences consumers' willingness to buy functional foods. Similarly, Verbeke (2005) examined that *belief in health benefits* of functional foods and *perceived role of food for health* are associated positively with functional food acceptance. According to the study, *health benefit belief* "is the main positive determinant of acceptance" (Verbeke, 2005, p. 45). It is therefore hypothesized that:

H2 - Perceived compatibility with consumers' personal values has a positive influence on consumers' innovation adoption of functional food product innovations.

Trialability

Trialability "do not represent benefits per se but may enable the potential adopter to more effectively assess the benefits of the innovation" (Arts et al., 2011, p. 136), "helps reduce consumer uncertainty about product use" (Flight et al., 2011, p. 344) and "helps the potential adopter to assess the extent of behavioral change required" (Arts et al., 2011, p. 136). The possibility to try a product,

or certain features of it, has been tested successfully as a factor enhancing the willingness to adopt the innovation over several product categories (see Agarwal & Prasad, 1997; Flight et al., 2011; Herbig & Day, 1992; Holak, 1988; M. C. Lee, 2009; Y. Lee & Kozar, 2008; More, 1982; Schneider, U., Dütschke, E., & Peters, 2014; Venkatesh et al., 2003). For example, several technical innovations can be tried out on a limited basis, such as the test driving of electronic vehicles (Schneider, U., Dütschke, E., & Peters, 2014), as well as IT related contexts like installing a test version of the software before deciding whether to adopt the full premium version (Y. Lee & Kozar, 2008). Nevertheless, concerning functional foods product innovations, it has not been addressed directly in the literature yet, although it might be an interesting factor to take a closer look at, too.

In business practice, promotions, trials and tastings have long been used as marketing operations for food products. Yet there could not be evidence found in functional food related literature of these actions having an influence on innovation adoption. This study proposes, that consumers who are able to try the product before actually purchasing it have an increased willingness to adopt, since *trialability* could lower uncertainties, building trust in the product and brand, and enables the consumer to better test and experience several other factors before buying: *taste* (*relative advantage*), *ease of use*, *physical risk*, and potentially a *health benefit* (*relative advantage*). It is therefore hypothesized, that:

H3 - Perceived trialability has a positive influence on consumers' innovation adoption of functional food product innovations.

Usage Barrier

The barrier to adopt an innovation based on resistance towards its functional usability is twofold: on the one hand, the question is whether the innovative product is easy or difficult to use. On the other hand, the level of change in existing habits required by the customer needs to be considered (Kleijnen et al., 2009; Laukkanen, 2016; Ram & Sheth, 1989). Existing habits may have to be adjusted, in order to be able to use the innovation (Ram & Sheth, 1989, p. 7). This *habit change* requires some initial effort, and may incur *switching costs* to the consumer to use the innovation, which can lead to resistance (Labrecque et al., 2017), especially if the consumer is rather satisfied with the current solution (Kleijnen et al., 2009). Research has pointed out the importance of habits for *innovation adoption*, such as Sheth (1981): "the strength of habit associated with an existing practice or behavior is hypothesized to be the single most powerful determinant in generating resistance to change" (Sheth, 1981, p. 275).

Resistance due to a required habit change can not only occur prior to purchase, through an active decision against a habitual change (Kleijnen et al., 2009), but also after buying the product by passively or unintentionally slipping back into older habits (Labrecque et al., 2017; Ram & Sheth, 1989). Since consumers have to deal with food products on a daily basis, it is likely that they build certain habits and routines around food consumption and purchase. These habits and routines might have to be adjusted or replaced when adopting food product innovations. According to Siegrist et al. (2015), "novel food products will only be viable if consumers are willing to accept them as part of their daily diet" (Siegrist et al., 2015, p. 87). It is therefore hypothesized that:

H4 - Perceived habit change has a negative influence on consumers' innovation adoption of functional food product innovations.

Value Barrier

"A number of previous empirical studies have also identified the premium price for functional foods as a major hurdle to acceptance and buying intention" (Verbeke, 2005, p. 48). Verbeke (2005) finds as well, that if functional foods are perceived as being too expensive, the likelihood of acceptance is lowered. Consumers are willing to pay more for functional foods offering a proven *health benefit*, compared to their conventional food alternatives, but at a price lower than currently reflected in the retail prices (J. A. Bower, Saadat, & Whitten, 2003). Furthermore, several other studies on functional food acceptance examined *price* to be an influential product attribute in consumers' perception (Siegrist et al., 2015; Urala & Lähteenmäki, 2003). It is therefore proposed that resistance to functional food product innovation can be found in *price*.

In resistance models, resistance due to financial reasons is mainly reported in two barriers: the *value barrier* and the *economic risk barrier* (Kleijnen et al., 2009; Ram & Sheth, 1989). Whilst the *value barrier* refers to the misleading perceived price-to-performance ratio of the product innovation, the *economic risk barrier* refers to general risk of wasting capital in two ways: that the (technology-related) innovation will decrease in price soon, leading to postponement of adoption (Ram & Sheth, 1989), or that the (high-tech) innovation requires a high level investment all at once (Dhebar, 1996; Kleijnen et al., 2009).

Mellentin (2014) reports that there is a general price premium of functional foods, which can lead up to 800% compared to the conventional food product equivalent. However, in absolute prices, this seldom still leads to really high investments for the consumer, if one compares it to innovation in other product categories, such as high-tech, buying an electronic vehicle, or a micro wind turbine, for example. Additionally, a significant short-term price decrease, due to technological progress, is not as likely as for other product innovations (e.g. in high-tech). It is therefore proposed, in the case of functional foods, that resistance as a result of perceived high prices are more seen in value-to-price relation terms than in risk terms (of losing a high amount of money or consumers having absolute price limits). As a result, the value barrier is tested by proposing the following hypothesis:

H5 - Perceived high price to value relation has a negative influence on consumers' innovation adoption of functional food product innovations.

Risk Barrier

An innovation brings changes, including some uncertainties for the consumer, which might be recognized by them, and associated with perceived risks, leading to resistance to the innovation (Ram & Sheth, 1989, p. 8). The risk barrier has been investigated to be the major resistance factor (Kleijnen et al., 2009). In line with previous research on risks and new product uncertainties of Kleijnen et al. (2009) and Ram & Sheth (1989, p. 8) the *risk barrier* can be broken down into four aspects of risks: *functional risk, economic risk*, *social risk,* and *physical risk.*

1) *Functional risk* refers to performance uncertainties and describes the fear that on the one hand an innovation will not function properly, due to the fact that the product is quite new (Ram & Sheth, 1989), as well as the notion that it would not function properly together with existing or upcoming products (Labrecque et al., 2017). In the case of functional foods, the *functional risk* is relatively comparable to the *physical risk* that the nutritional effect is not as intended, or in fact harmful to the user's health.

2) *Economic risk* is the "concern that the innovation will be a waste of resources" (Kleijnen et al., 2009, p. 349). *Economic risk* increases with higher capital cost/ price of the innovation (Ram & Sheth, 1989, p. 8). Despite the importance of the *economic risk*, the *value barrier* is proposed to be a more relevant factor in the case of functional foods, as stated above.
3) *Social risk* refers to the fear of being judged negatively by other members of a social circle when using the innovation (Ram & Sheth, 1989, p. 8). As for any innovation, this risk might be present, but it is proposed to be a minor form of influence for functional foods, since they are often used in a private space with a low chance of external people noticing it, as well as mostly having the appearance of conventional food from its appearance. This is also in line with research which reported *social risk* to be the least important risk aspect for consumers (Kleijnen et al., 2009, p. 350).
4) *Physical risk* is the "concern that the innovation might be harmful, unhealthy or cause injury" (Kleijnen et al., 2009, p. 348). *Physical risks* may be relatively rare for most products, but they are especially present in food products (Labrecque et al., 2017), which applies especially to all processed foods (Ram & Sheth, 1989, p. 8). Applied to the case of food, and functional food product innovations, it can be seen as the fear of the consumer that the new product will be harmful to their health, or even poisonous or allergy triggering, or that it has an unintended effect on the body. Alongside this, the fear of trying new food products has been identified by several research and is described as *food neophobia* (Pliner & Hobden, 1992; Siegrist, 2008; Siegrist et al., 2013; Trijp et al., 2008; Urala & Lähteenmäki, 2007).

Consequently, for the current study on functional foods, *physical risk* is proposed to be the strongest risk associated with product innovations, which is why this aspect of risk is tested predominantly.

This is in accordance with the research in the field of food and functional foods. Siegrist reported on the factor of *perceived risks,* which is negatively correlated with willingness to buy novel food products (Siegrist, 2008, p. 604; Siegrist, Cousin, Kastenholz, & Wiek, 2007). *Primary health concerns* are reported to be a factor that influences consumers' functional food acceptance (Siró et al., 2008, p. 465) as well as *safety of functional food* (Urala & Lähteenmäki, 2007).

A whole body of literature concerning the related topic of *food neophobia* can be found. Individuals have different levels of willingness to eat novel foods (Siegrist et al., 2015). To account for this phenomenon, Pliner & Hobden (1992) introduced the concept of food neophobia, which describes the fear of trying new food products. Several studies on functional foods reported the presence of *food neophobia*, and examined a significant correlation between *food neophobia* and *willingness to buy or use functional foods* (Siegrist, 2008; Siegrist et al., 2015; Urala & Lähteenmäki, 2007). These studies suggest that consumers with more distinct *food neophobia* are less likely to accept functional foods. According to Verbeke (2005, p. 54), "Europeans being more critical towards novel foods, novel food technology and food-related information" (Verbeke, 2005, p. 54) compared to US-consumers, which makes the factor especially relevant to the current research on the German market. It is therefore hypothesized that:

H6 - Perceived physical risk has a negative influence on consumers' innovation adoption of functional food product innovations.

Image Barrier

Perceived *image* can be defined as "unique set of associations within the minds of customers, based on e.g., the product category that the innovation belongs to, the manufacturer that produces it, or the country where it is produced" (Kleijnen et al., 2009, p. 348). If the perceived *image* is unfavourable, this propensity can be applied to the product innovation, leading to resistance (Ram & Sheth, 1989, p. 9). Consumers' judgement by *image* might especially arise when actual product characteristics are difficult to observe (Kleijnen et al., 2009, p. 346).

The most importantly aspect related to this in the field of functional foods has been identified in the literature as *trust*. Functional foods only have physiological effects that are not as strong as medical effects. *Health benefits* may therefore not directly be experienced by the consumers (L. Frewer et al., 2003). The effects and benefits therefore have to be communicated by the distributor and therefore it depends on how much the consumer trusts these information (L. J. Frewer et al., 1996; Urala & Lähteenmäki, 2003).

Furthermore, Siegrist (2008) argued that the benefits and risks of functional food products might not fully and directly be experienced by consumer, which is why consumers have to rely on the promises made by the companies (Siegrist, 2008). In this regard, he found that consumers who had a higher level of *trust* in the food industry showed higher intention to buy functional food, compared to consumers who do not (Siegrist, 2008). A later study supports the findings of *trust* being a factor that influences consumers' willingness to buy functional food (Siegrist et al., 2015). The study also suggests that *trust* is an especially relevant factor on the German market, compared to other countries like China (Siegrist et al., 2015). In this regard, the lack of *trust* in functional foods, claims made by the companies, and in the industry itself is seen as a major barrier to adoption of functional food product innovations. It is therefore hypothesized that:

H7 - Perceived lack of trust in claims made by suppliers has a negative influence on consumers' innovation adoption of functional food product innovations.

Innovation Adoption: Adoption Intention and Adoption Behavior

While *adoption intention* "refers to a consumer's expressed desire to purchase a new product in the near future" (Arts et al., 2011, p. 135), *adoption behavior* describes the purchase of an innovation (Rogers, 2003). In most research on adoption decisions, it seems to be taken as a given that *adoption intention* predicts the actual *adoption behavior*, which is why oftentimes the only dependent variable studied is adoption intention. For example, in an older meta-analysis on innovation characteristics by Tornatzky & Klein (1982), only 2 out of 75 studies also looked at adoption implementation as a dependent variable, next to *adoption intention*. Intention and behavior have even been used interchangeably in several studies (Sheppard, Hartwick, & Warshaw, 1988, p. 327).

This partly results from the work done in behavioral studies in sociology research, where *behavioral intention* has been seen as a valid indicator for actual *behavior*. Researchers in this field pointed out that "as a general rule it is found that when behaviors pose no serious problems of control, they can be predicted from intentions with considerable accuracy" (Ajzen, 1991, p. 186). This relation has been tested in several experimental studies, such as those for presidential election voting – there is a 75%-80% correlation between *intention* and *behavior* (Fishbein & Ajzen, 1981) or mothers' feeding method for their newborn babies – a 82% correlation between *intention* and *behavior* (Manstead, Proffitt, & Smart, 1983). Accordingly, the relationship is generally applied to studies making use of

the *TRA*, *TPB* or *TAM* models. Furthermore, with market research looking at purchase intentions mainly to predict future buying behavior, this has become a common approach in business practice, as well (Arts et al., 2011, p. 134).

However, in the experience of companies, consumers who expressed *adoption intent* often do not actually buy the product later on and also "research has shown that consumer intentions to adopt innovations are often poor predictors of adoption behavior" (Arts et al., 2011, p. 134). Examples include a study of Tornatzky & Klein (1982), who already came to the conclusion that "the failure to use degree-of-implementation as a dependent variable probably yields misleading correlations of innovation characteristics with innovation behavior" (Tornatzky & Klein, 1982, pp. 31–32). Furthermore, Hofmeyr & Brand (2007) reported on several product categories, including fast-moving consumer goods, where for purchase behavior, "91% of the variance is not captured by purchase intent" (Hofmeyr & Brand, 2007, p. 4). Additionally, Morwitz, Steckel, & Gupta (2007) found that "intentions are more correlated with purchase for existing products than for new ones" (Morwitz et al., 2007, p. 347), which might be a reason why there was a difference found in the predictive power of *intention* in adoption studies, compared to other behavioral research.

To account for all these indications in previous studies, there have been calls by several researchers to consider *intention* and *behavior* as two distinct dependent variables (see Arts et al., 2011; Bemmaor, 1995; Jamieson & Bass, 1989). These calls are beginning to be heard by adoption research.

As suggested in the meta-analysis by Arts et al. (2011, p. 135), the current study differentiates between *adoption intention* and *adoption behavior* as two separate dependent variables and refers to *innovation adoption* when referring to both concepts together. For all the identified adoption and resistance factors relevant to the topic of functional food innovations, the influence on *adoption intention* as well as on *adoption behavior* is tested.

2.10 Conceptual Model

Resulting from the introduced theories and the developed hypothesis, Figure 6 shows the conceptual model for this study. Compared to other adoption models, this study makes use of a reduced conceptual model, with just direct influence on *innovation adoption*, and selected factors relevant to the context of functional food:

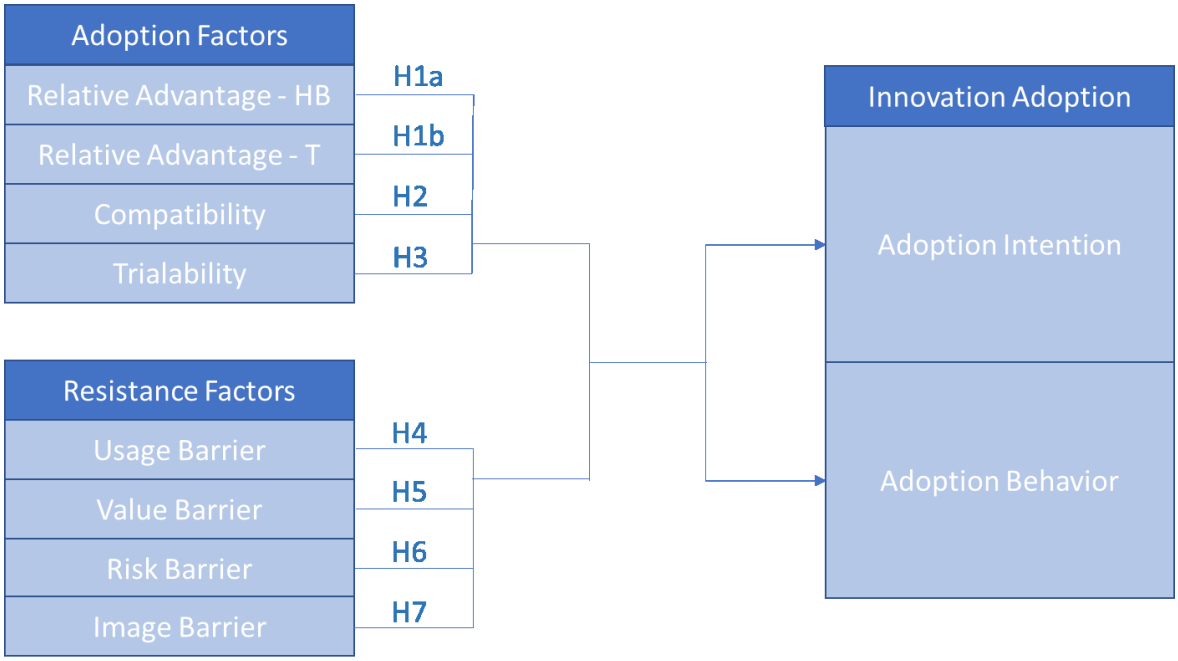

Figure 6: Conceptual model of the study.

The relationship between the dependent variables: *adoption intention* and *adoption behavior,* and the independent variables: *relative advantage, compatibility, trialability, usage barrier, value barrier, physical risk barrier* and *image barrier* is tested.

2.11 Socio-demographic Factors

Alongside the proposed hypothesis, a few socio-demographic factors are tested, as well. Several previous studies showed that certain consumer groups are more likely to adopt product innovation in general, but also in terms of functional foods.

Age

According to Verbeke (2005), there is a higher probability of functional food acceptance among older consumers, as examined in the USA. Concerning European consumers, the study of Poulsen (1999) supports this, finding the preferred age group for functional foods to be 55+. This might be explained by increased concerns about health related issues with increasing age (Lähteenmäki, 2013).

These findings for functional foods are in contrast to most adoption studies in other fields, which report a higher rate of adoption among younger customers (Arts et al., 2011, p. 142), as younger age groups are seen as more likely to have experience with innovations (Kleijnen et al., 2009, p. 349), might score higher on a scale of *personal innovativeness*, be more *open to innovation* and are more often considered to be *innovators* or *early adopters* (Rogers, 2003).

It is tested whether *age* is a significant factor in the current setup, and whether one effect outweighs the other in functional food adoption.

Gender

Throughout several past studies it is consistently reported that woman have a higher tendency of buying and using functional food products (Childs, 1997; de Jong, Ocké, Branderhorst, & Friele, 2003; Poulsen, 1999; Verbeke, 2005). This might in part be explained by women being more health conscious than men. The investigation aims to conclude whether this holds true or has changed in the recent time.

Education

While in the USA there is a clear tendency of functional food adopting consumers being educated more highly (Childs, 1997; Gilbert, 1997), the results for European consumers vary between low levels of education (Poulsen, 1999) and highly educated (Hilliam, 1996).

Excluded Socio-demographics

Other socio-demographic factors that potentially enhance acceptance of functional foods that have been reported about in the research are: *presence of an ill family member* (Verbeke, 2005), *young children in the household* (Verbeke, 2005) and higher *income class* (Childs, 1997).

These factors have not been included in the study. Furthermore, *country of origin* has been excluded, as the survey reached out only to consumers on the German market.

2.12 Psychographic Factors

There is a multitude of psychographic factors that have been studied in either adoption or food research, including *product involvement*, *opinion leadership*, *price consciousness*, *self-confidence* or *brand familiarity*. In the current study, additional data has been collected on the three psychographic factors: *innovativeness*, *health motivation* and *food neophobia*.

3 Methodology

3.1 Research Strategy

The research reflects the philosophy and epistemological position of positivism. The ontological position is rooted in objectivism. A deductive research approach is chosen that allows the testing of self-developed hypotheses, deduced from theory, which are subjected to empirical data to test existing theoretical knowledge (Saunders, Lewis, & Thornhill, 2009, p. 124). The research aims to explain causal relationships between variables by collecting quantitative data. Although the researcher is working in the field, an objectively phrased self-completion survey is used for independent data collection, retaining the principle of scientific rigor (Saunders et al., 2009, p. 125). Therefore, the quantitative research approach is chosen to collect primary data.

3.2 Research Design

Data is collected by means of a social survey with an online questionnaire for self-completion. This collection was carried out at one particular time, covering several variables and cases which are then analyzed and compared, which speaks for a cross-sectional design. The responses where collected over a period of 12 days in March 2018. Subject to the investigation are consumers on the German market (residence in Germany, age > 14), so the analysis is taking place at the level of individuals.

The main part of the study concerns the influence of different factors on *adoption intention*, as well as *adoption behavior* for product innovations in the functional food sector in general. Subsequently, a case experiment is run as a second part of the study, to add supplementary context to the investigation. To accomplish this, a conceptual case of a new functional food product from *Neuronade's* product pipeline is provided by the project partner of the study. The concept and description of this new functional food innovation, called *FocusGum*, as presented to the survey participants, can be found in the appendix figure A1. In their meta-analyses on 77 studies on innovation adoption, published from 1970 to mid-2007, Arts et al. (2011) identified that "over 60% of the studies focused on analyzing a single innovation" (Arts et al., 2011, p. 137). Therefore, a complementing case study looking at a single innovation in the functional food sector seemed to be appropriate for the current study's purpose.

Additionally, Tornatzky & Klein (1982, p. 40) suggested guidelines on how research in an ideal innovation characteristics study should be designed and implemented, which are followed in this study. For example they suggested that the study should "utilize research approaches that are reliable, replicable, and permit some degree of statistical power: Surveys, secondary data analysis, and experiments may be methodologically adequate in this sense" (Tornatzky & Klein, 1982, p. 29) and the "assessment of an innovation attribute to be obtained prior to, or concurrently with, a decision to adopt the innovation" (Tornatzky & Klein, 1982, p. 29).

To account for this, the survey is split into different parts, which are to be completed one by one. The order chosen in such a way that parts are not influenced by each other. The first part aims to capture

the general opinion on functional food innovation and the perceived importance of different *innovation characteristics*, as well as barriers, without being biased towards a special product. After completing this section, participants are presented with the second part, containing the case experiment on the special functional food product innovation case of *FocusGum*. An explanation and image of the product is provided, followed by closed questions on the different factors and *adoption intention*. Additionally, participants have the possibility to rank the factors by importance, and name additional ones. After finishing these questions, a new page opens, presenting the opportunity to pre-order the product in question immediately via *Neuronade.com's* own online-shop. This makes it possible for participants to show actual *adoption behavior* in a testable way. The last page of the survey, which follows, asks the participants for demographic facts and psychological tendencies, as well as giving the opportunity to comment on their decision of *adoption behavior* by filling in a free text field, allowing data for further exploratory investigations to be provided.

3.3 Research Method

In line with the research purpose and design, secondary data has been assessed, mainly by reviewing literature to develop a theoretical framework and conceptual model. On this basis, primary data is collected and analyzed.

3.3.1 Operationalization of Variables

There is not yet a survey of innovation characteristics and adoption barriers in the context of functional food product innovations established in the literature. The survey items used for this study have been adopted or adapted from existing scales of *innovation characteristics* and *adoption barriers*, as well as relevant literature on the topic of food. In total, eight consumer perceptions are included as independent variables in this study on *innovation characteristics*, of which four are adapted from the literature on adoption - *relative advantage* (separated into *health benefit* and *taste*), *compatibility* (*personal compatibility*), *trialability* - and four from literature on resistance - *usage barrier* (*habit change*), *value barrier* (*price*), *risk barrier* (*physical*), and *image barrier* (*trust*). The dependent variable is *innovation adoption*, distinguished by *adoption intention* and *adoption behavior*.

In line with a meta-analysis of *innovation adoption* scales, the item "was coded as adoption intention when the dependent variable was operationalized by asking respondents to rate their intention to purchase an innovation in the future" and the item "was coded as adoption behavior when the dependent variable was operationalized as a purchase of the innovation" (Arts et al., 2011, p. 137). The full list of operationalized variables can be found in table A1 in the appendix. The survey items are either adopted or adapted from other studies in the field. Where possible, the factors are taken from meta-analyses on scale development. Data on each variable is collected with a minimum of two items that have been included in the survey. For coding the questions, the 5-point Likert-Scale have been chosen, as the most appropriate way to measure the participants' tendencies, providing the opportunity for choosing a neutral option, as well. Some of the items are reverse coded.

Survey Item	Source
In my opinion, new functional food products…	
Relative Advantage – Health Benefits	
… have a favorable health benefit over their conventional food equivalent.	Adapted from Flight et al. (2011)
Relative Advantage – Taste	
… are acceptable for me, even if they taste worse than their conventional food alternative.	Verbeke (2005)
Personal Compatibility	
Using them would be in line with my own personal values.	Adapted from Claudy et al. (2015)
Trialability	
It is important that I can try new functional foods out before purchase.	Adapted from Flight et al. (2011), Agarwal & Prasad (1997)
Usage Barrier	
Using new functional foods would require significant changes in my existing daily routines and eating habits.	Adapted from Karahanna, Agarwal, & Angst (2006)
Value Barrier	
… are too expensive given their claimed health benefit.	Verbeke (2005)
Risk Barrier – Physical Risk	
… can cause serious unintended negative effects to my body.	Adapted from Wiedmann et al. (2011)
Image Barrier – Trust	
I have trust in the claims made by the suppliers of new functional foods	Adapted from Siegrist (2008)
Adoption Intention	
I intend to include new functional foods in my diet in the future.	Adapted from Agarwal & Prasad (1997)
Adoption Behavior	
I include new functional foods whenever possible and reasonable in my diet.	Adapted from Agarwal & Prasad (1997)

Table 5: Examples of survey items used. The full list can be found in the appendix table A1.

The original survey items are in English. Since the research is conducted with consumers on the German market, the survey items are translated into German to avoid problems with understanding the questions and statements. The translation into German was made by the author. To ensure that the translation in in accordance with the original survey items, a back-translation has been performed by an independent bilingual translator, who spent half of their life in Germany and the United States, respectively. The back-translation matches well with the original survey items. Two German items were adjusted in response to the back-translation.

The survey items with included translation, back translation, reverse coding, and source can be found in table A1 in the appendix.

3.3.2 Data Collection

For collection of primary data, a standardized self-completion online questionnaire has been conducted in several steps. First of all, a preliminary version of the survey was created and pre-tested. To do so, experts where asked to comment on the suitability and representativeness of the questions, as suggested by Saunders et al. (2009), to establish content validity and make possible adjustments (Saunders et al., 2009, p. 394). More precisely, two consumers, two representatives of the partnering company, and the supervisor of this study have been asked for their feedback. The survey has been adjusted accordingly.

Before sending out the final survey, a pilot survey was conducted and sent out to 10 consumers, of which 6 fully completed the survey. The participants of the pilot survey were contacted and asked to comment on their experience with the survey. As a result, some minor corrections were made to the German wording, as well as some spelling corrections, and the possibility to indicate factors and reasons for or against their buying decisions, by means of open questions, was added. Pilot tests also help "to obtain some assessment of the questions' validity and the likely reliability of the data that will be collected" (Saunders et al., 2009, p. 394).

The survey has been developed and published using the browser interface version of *Qualtrics*. The survey can be seen in the appendix figure A1. The final survey was distributed by sending the URLs to *Neuronade's* e-mail list, private social media networks, and research groups. The URLs were publicly visible and could be reached by anyone. The aim has been to reach a heterogeneous sample of the addressed population (consumers on the German market; residence in Germany, age > 14), by applying simple random sampling.

Responses were collected during a 12-day time-period in March 2018. In total, there were 348 participants who filled in the survey. Of these 348 responses, 29 were incomplete (e.g. demographic data missing), and were therefore deleted. Another 3 responses have been excluded, due to a lack of interest in the survey (only the neutral options were selected in too short a time to read the questions). In conclusion, this leads to a final sample size of N = 316 of complete data sets, with which the data analysis is conducted.

3.3.3 Sample

Gender

		Frequency	Percent	Valid Percent
Valid	Female	172	54,4	54,4
	Male	144	45,6	45,6
	Total	316	100,0	100,0

Table 6: Gender distribution of the sample.

Gender is well distributed, as it resembles the German population (Destatis, 2018).

Age

		Frequency	Percent	Valid Percent
Valid	< 21	14	4,4	4,4
	21 - 30	176	55,7	55,7
	31 - 40	44	13,9	13,9
	41 - 50	34	10,8	10,8
	51 - 60	34	10,8	10,8
	61 - 70	11	3,5	3,5
	> 70	3	0,9	0,9
	Total	316	100,0	100,0

Table 7: Age distribution of the sample.

Participants have come out of every age group. Nevertheless, ages between 21-30 have been most prevalent with 55,7%. This can be explained by the fact that younger people are more willing to participate in the data collection method of an online questionnaire, due to their higher internet affinity compared to other age groups. Other factors contributing to this are the distribution of the survey via in social networks, and the fact that a large number of customers of *Neuronade* are in this age group.

Education

		Frequency	Percent	Valid Percent
Valid	University	228	72,2	72,2
	Abitur	44	13,9	13,9
	Realschule	8	2,5	2,5
	Ausbildung	36	11,4	11,4
	Total	316	100,0	100,0

Table 8: Distribution of educational level of the sample.

A dominant number of respondents have received a higher education, as shown in table 8.

3.3.4 Data Analysis

The data is analyzed in *SPSS* version 25. All data from survey responses has been exported from *Qualtrics* into one big set of data. This set has been edited by deleting complete sets, naming items and variables, and adjusting reverse coded items.

First, descriptive statistics are used to provide an overview of respondents' demographical backgrounds. Next, the scale reliability and internal consistency of measures is controlled by analyzing Cronbach's alpha for each variable, as well as looking at the item correlation by applying Pearson correlation. The significance level is determined with $\alpha = 0,05$. From reliable item scales, means have been calculated to attain the final variable. Another Pearson correlation is used for inferential analysis to measure the strength of linear relationships between variables. Bivariate relationships between the dependent variables *intention* or *behavior*, and the independent variables innovation characteristics, adopters' socio-demographics and adopters' psychographics, have in general been analyzed by means of correlation coefficients (Arts et al., 2011, p. 137). If a significant

relationship between the independent and dependent variables can be found, a multiple linear regression is performed to assess the influence of the eight independent variables on the dependent variable and the strength of relationship between them. Six requirements of the multiple regression analysis are checked, namely: linear relationship between variables, independence of residuals, no outliers, multicollinearity, homoscedasticity, and normality. The statistical significance of the model is analyzed with ANOVA. To analyze the proportion of the explained variation in the dependent variable that is predicted by the independent variables, the coefficient of multiple determination is analyzed (R^2 and adjusted R^2 respectively).

"Studies on adoption behavior typically analyze the perceptions and characteristics of consumers who have already purchased the innovation relative to those who have not" (Arts et al., 2011, p. 135), which is why there is a distinct analysis of factors conducted between consumers who do not intend to adopt, who intend to adopt, or showed adoption behavior (Arts et al., 2011, p. 135). To account for this, Arts et al. (2011) suggests performing two multiple linear regression analyses, one with adoption intention and the other with adoption behavior as the dependent variable.

Therefore, the multiple regression equations for the current study are:

$$AI = \beta_0 + \beta_1 RAH + \beta_2 RAT + \beta_3 CP + \beta_4 TR + \beta_5 UB + \beta_6 VB + \beta_7 RB + \beta_8 IB$$

$$AB = \beta_0 + \beta_1 RAH + \beta_2 RAT + \beta_3 CP + \beta_4 TR + \beta_5 UB + \beta_6 VB + \beta_7 RB + \beta_8 IB$$

RAH = Relative Advantage – Health Benefit
RAT = Relative Advantage – Taste
CP = Compatibility (Personal)
TR = Trialability
UB = Usage Barrier
VB = Value Barrier
RB = Risk Barrier
IB = Image Barrier
Innovation Adoption:
AI = Adoption Intention
AB = Adoption Behavior

For the second part of the survey with the case experiment, data is mainly analyzed by grouping responses into *adoption intention* and *no adoption intention*, as well as comparing the descriptive statistics of both groups. For the open questions, a form of open coding is used to segment the data into units of meaning and attribute them with associated concepts.

3.3.5 Reliability and Validity

Validity is concerned with the question of whether a model measures the presence of those constructs that are intended to be measured (Saunders et al., 2009, p. 372). In order to ensure internal validity of the used approach, content validity is checked. Content validity has been addressed with face validity considerations by pre-examining and pilot testing the survey, as described earlier. The items are selected from tested scales of previous research and discussed for adequate coverage with the research object, as well as with experts in the field of examination. Furthermore, the probability-based sampling method of simple random sampling is chosen.

Reliability is concerned with the robustness of the survey and refers to its consistency. A survey is consistent, if it will produce the same findings at different times under different conditions (Saunders et al., 2009, p. 373). To address reliability, internal consistency is checked by calculation of Cronbach's alpha. This measure revealed satisfying results as shown in the Result chapter. Additionally, the relatively large sample size lowers the risk of random errors.

3.4 Scale Measurement

3.4.1 Reliability Considerations

In order to get an initial look at tendencies of the results, the mean and standard deviation is analyzed for every survey item (table 9).

Descriptive Statistics (Items)

	N	Mean	Std. Deviation
RAH1	316	3,32	1,002
RAH2	316	3,00	,921
RAH3	316	3,24	1,092
RAH4	316	2,97	1,054
RAT1	316	3,89	,873
RAT2	316	3,77	1,036
CP1	316	3,61	,984
CP2	316	3,40	1,132
TR1	316	3,81	1,076
TR2	316	2,51	1,298
UB1	316	2,51	1,050
UB2	316	2,66	1,095
VB1	316	3,63	,955
VB2	316	3,41	,924
RB1	316	2,63	1,036
RB2	316	2,66	1,191
IB1	316	2,93	1,074
IB2	316	3,70	1,031
AI1	316	3,12	1,116
AI2	316	2,95	1,106
AI3	316	3,02	1,114
AB1	316	2,78	1,272
AB2	316	2,65	1,185
AB3	316	2,96	1,210
Valid N (listwise)	316		

Table 9: Mean and standard deviation of survey items.

The means range from μ = 2,51 (TR2, UB1) to μ = 3,89 (RAT1). Comparing the means and standard deviations for each variable, it can be said that vary only within in a low range. The exceptions to that are TR and IB, which vary quite highly compared to other variables (means - TR1: μ = 3,81; TR2: μ = 2,51 and IB1: μ = 2,93; IB2: μ = 3,7), and with TR2 having the highest standard deviation of all items, with σ = 1,3. In general, it has been attempted to cover a wider range of each variable with the respective survey items, rather than asking almost the same question several times. Especially in the case of trialability, this did not work out. The problematic cases are discussed in detail in the next paragraph.

For reliability analysis, Cronbach's alpha is calculated to assess the internal consistency of the subscales for each variable.

Variable	Number of items	Cronbach's alpha
RAH	4	0,79
RAT	2	- 0, 27
CP	2	0,80
TR	2	0,40
UB	2	0,68
VB	2	0,66
RB	2	0,81
IB	2	0,75
AI	3	0,93
AB	3	0,86

Table 10: Cronbach's alpha for each variable.

As suggested by literature, a Cronbach's alpha value higher than 0,7 is considered to show sufficient reliability (Nunnally & Bernstein, 1994). For the green shaded variables, the internal consistency of the survey items is satisfying, with a Cronbach's alpha of > 0,7. For the yellow shaded variables, the value is close to, but under 0,7, which is why they have to be further investigated.

For the respective survey items UB and VB, a bivariate correlation is run. The variables RAH, CP, RB, IB, AI, and AB have a satisfying correlation coefficient of r > 0,3. The variables UB and VB are in questions since Cronbach's alpha is slightly below 0,7. For these variables, the correlation coefficients are satisfying (VB1 with VB2: r = 0,507; UB1 with UB2: r = 0,531), which is why they appear to be reliable for further analyses. TR and RAT yielded insufficient results in this analysis.

In conclusion, RAH, CP, UB, VB, RB, AI and AB directly fulfill the reliability norms for the study. For each of these variables, the mean of the corresponding survey items is calculated and used for the further analyses with the variable.

3.4.2 Discussion of Problematic Cases

The analysis revealed some difficulties with the three variables RAT, TR and IB, which have to be discussed.

RAT

Looking at the means of RAT1 and RAT2, they seem to generate quite similar results. Nevertheless, a Cronbach's alpha analysis revealed a very bad value for internal consistency. A bivariate Pearson Correlation showed a value of r = -0,12, which is insufficient, too. A further investigation of the scale used by Verbeke (2005), revealed that he, too, had major problems with the proposed scale, which are not addressed in an obvious manner in his study. In the study, he then excluded problematic data sets to get to a good conclusion. For purposes of the current study, the decision is made not to follow this approach, as it could change the results of the other variables and is not seen as an appropriate method. Further analysis may have to be performed with data from one item only, preferably RAT2. Nevertheless, there has been no major change when performing the calculations with RAT2 instead of RAT (RAT2 and RAT are both significant and have similar β-coefficients in both cases), meaning the variable is used as proposed. However, it has to be kept in mind for further evaluation and interpretation, that the reliability of RAT is questionable.

TR

For items TR1 and TR2, the means are very different, the correlation coefficient is lower than r = 0,3 (r = 0,256) and Cronbach's alpha is with 0,4 below 0,7. The two different characteristics of trialability have been judged quite differently by participants. The item TR1 is capturing the core of the variable TR and has a more reasonable standard deviation, which is why only TR1 is used for further calculations, while TR2 has been excluded. Nevertheless, the results of TR2 lead to an additional finding which is discussed in detail in the next chapter.

IB

In the case of IB, the means of IB1 and IB2 differ a lot. Looking at Cronbach's alpha, there would be no urgent need to exclude one of these items. Nevertheless, the decided is made to exclude IB1 from further analysis, and to concentrate on the effect of trust concerning the claims made by suppliers.

In conclusion, all items except TR2 and IB1 are included in further analyses.

3.4.3 Normality Considerations

A Kolmogorov-Smirnov test and a Sharpio-Wilk test is performed to test for normality (table 11).

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
AI	,129	316	,000	,961	316	,000
AB	,086	316	,000	,963	316	,000

a. Lilliefors Significance Correction

Table 11: Results normality analysis.

According to the results, the dependent variables aren't normally distributed, as the p-value is < 0,001; which is lower than the significant level (< 0,05) for both tests. Nevertheless, normal distribution can be assumed for several reasons, such as the Central Limit Theorem, according to

which normal distribution can be assumed for sample sizes N ≥ 30. Furthermore, a visual assessment of the Q-Q-Plots suggests that the variables are approximately normally distributed, as shown in Figure 7 and 8.

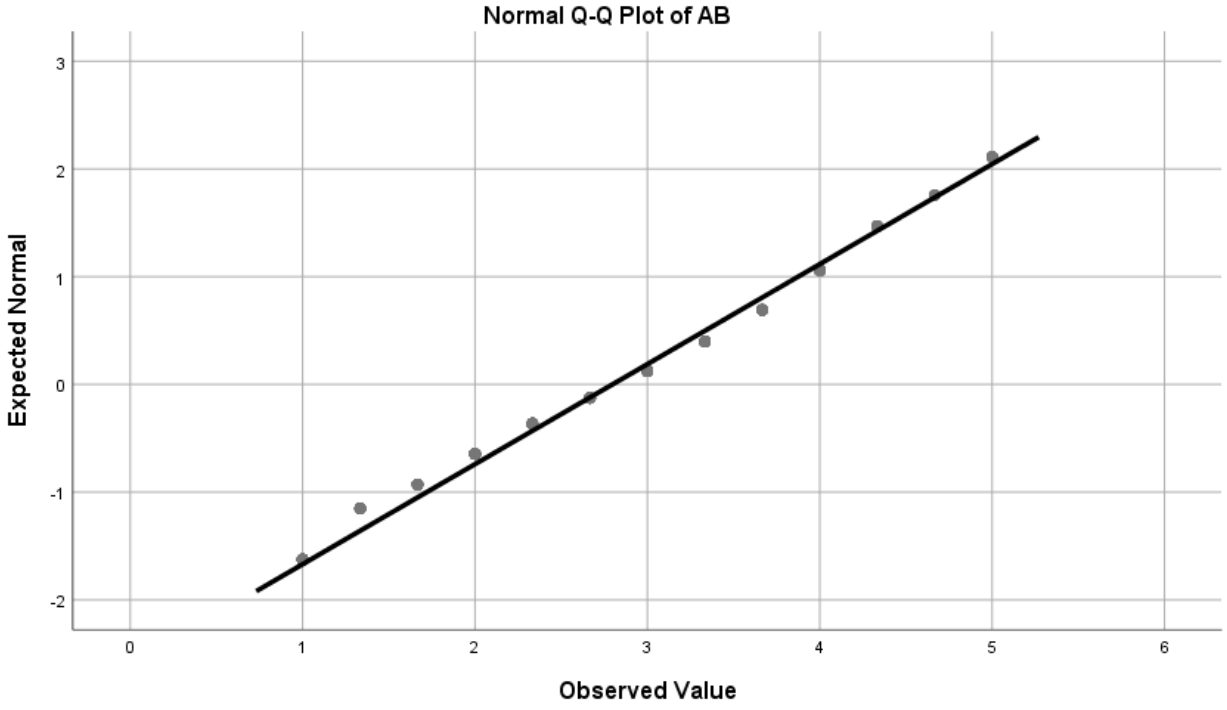

Figure 7: Q-Q plot of adoption behavior.

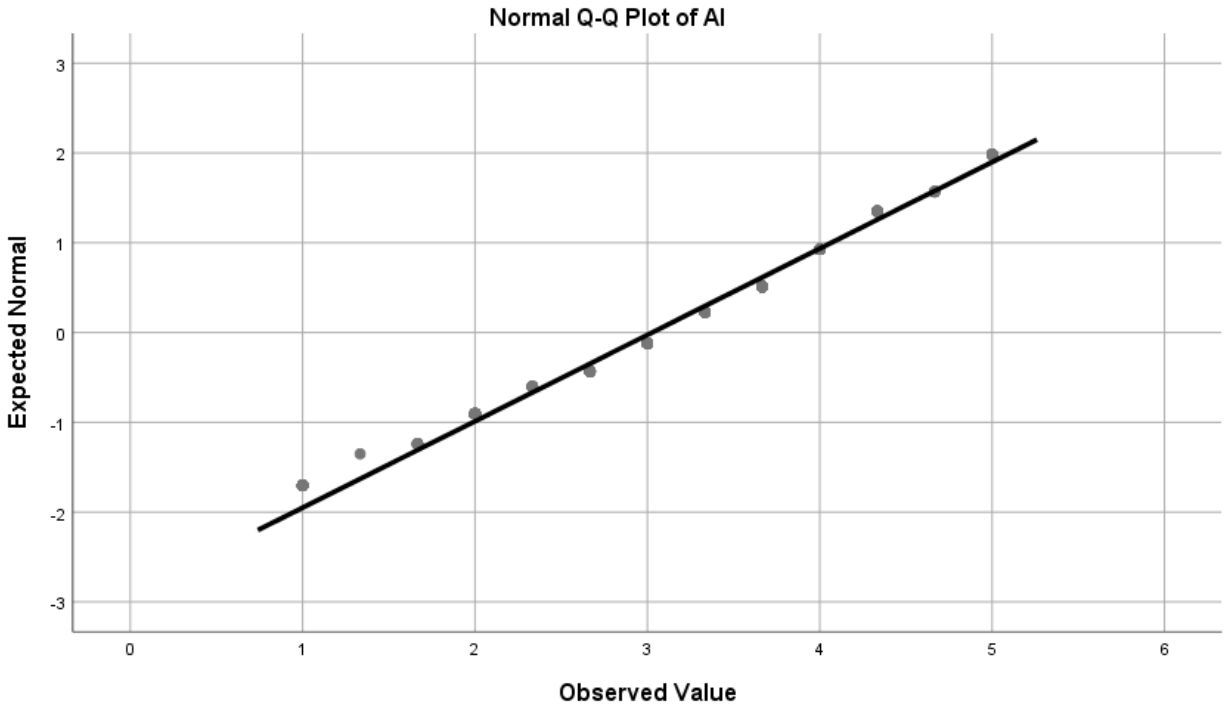

Figure 8: Q-Q plot of adoption intention.

3.4.4 Pearson Correlation

A correlation analysis reveals whether the constructs are related, and whether their relationship is positive or negative. For this purpose, a Pearson correlation is run.

Correlations of Variables

		AI	AB	RAH	RAT	CP	TR1	UB	VB	RB	IB2
AI	Pearson Correlation	1	,742**	,592**	-,160**	,633**	,286**	-,146**	-,414**	-,234**	-,421**
	Sig. (2-tailed)		,000	,000	,004	,000	,000	,009	,000	,000	,000
AB	Pearson Correlation	,742**	1	,575**	-,220**	,600**	,272**	-,190**	-,313**	-,198**	-,370**
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,001	,000	,000	,000
RAH	Pearson Correlation	,592**	,575**	1	-,075	,659**	,152**	-,115*	-,452**	-,326**	-,486**
	Sig. (2-tailed)	,000	,000		,183	,000	,007	,040	,000	,000	,000
RAT	Pearson Correlation	-,160**	-,220**	-,075	1	-,115*	,042	-,032	,072	,010	,053
	Sig. (2-tailed)	,004	,000	,183		,041	,452	,569	,199	,862	,348
CP	Pearson Correlation	,633**	,600**	,659**	-,115*	1	,183**	-,287**	-,380**	-,340**	-,406**
	Sig. (2-tailed)	,000	,000	,000	,041		,001	,000	,000	,000	,000
TR1	Pearson Correlation	,286**	,272**	,152**	,042	,183**	1	,022	,029	,051	,019
	Sig. (2-tailed)	,000	,000	,007	,452	,001		,698	,610	,370	,731
UB	Pearson Correlation	-,146**	-,190**	-,115*	-,032	-,287**	,022	1	,178**	,154**	,067
	Sig. (2-tailed)	,009	,001	,040	,569	,000	,698		,001	,006	,233
VB	Pearson Correlation	-,414**	-,313**	-,452**	,072	-,380**	,029	,178**	1	,213**	,484**
	Sig. (2-tailed)	,000	,000	,000	,199	,000	,610	,001		,000	,000
RB	Pearson Correlation	-,234**	-,198**	-,326**	,010	-,340**	,051	,154**	,213**	1	,327**
	Sig. (2-tailed)	,000	,000	,000	,862	,000	,370	,006	,000		,000

IB2	Pearson Correlation	-,421**	-,370**	-,486**	,053	-,406**	,019	,067	,484**	,327**	1
	Sig. (2-tailed)	,000	,000	,000	,348	,000	,731	,233	,000	,000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 12: Results of Pearson correlation.

According to the Pearson correlation, a statistically significant linear relationship can be found between all of the 8 independent variables for each dependent variable AI and AB. All p-values are below $\alpha = 0{,}01$. None of the correlations between the independent variables are above $r = 0{,}7$, which indicates that there is no multicollinearity. The strongest relationship is between AI and AB, with $r = 0{,}74$, which is a result that is discussed in the next chapter, as well. CP, RAH, IB and VB are highly correlated with AI, as well as with AB.

3.5 Elements of Multiple Linear Regression

3.5.1 Checking of Requirements to Perform Multiple Linear Regression

The linear relationship of the variables, as well as the normality of residuals, have already been shown.

Checking for outliers

To run linear multiple regression, there should be no outliers in the sample. Studentized Deleted Residuals, Cook's Distance, and the Centered Leverage Value are calculated for each response. The Studentized Deleted Residuals reveal that there is one response that exceeds the limit of ± 3. Nevertheless, the Centered Leverage Value shows no problem for this response, as well as for all the other responses. Similarly, all values for Cook's Distance are below the limit of 1. Therefore, no data set had to be excluded.

Independence of residuals

Since the value of the Durbin-Watson statistic, is at 2,029 and 1,904, very close to the targeted value of 2, the model has no auto-correlation. The results for the Durbin-Watson statistic can be found in the appendix.

Multicollinearity

The Pearson correlation shows no value that exceeds 0,7. Furthermore, the values of tolerance are above 0,1 and the values for VIF below 10 (table 13). In conclusion, there should be no multicollinearity between predictor variables.

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	RAH	,476	2,102
	RAT	,975	1,026
	CP	,484	2,068
	TR1	,923	1,084
	UB	,878	1,139
	VB	,682	1,466
	RB	,820	1,219
	IB2	,641	1,559

Table 13: Results multicollinearity analysis.

Homoscedasticity

A scatterplot was generated showing the relationship between unstandardized predicted values and studentized residuals. Based on the visual judgement of the graphical output, there might be a problem with homoscedasticity. For evaluation of the results, it should be considered that there might be heteroscedasticity of residuals present in the data, which could speak for a weakened model.

3.5.2 Significance of the Model

R^2 describes the proportion of the variance in the dependent variable that is predicted by the independent variables. R^2 for the overall model is 0,52 (adjusted R^2 = 0.51), which indicates that 52% of the variance is explained by the tested model, speaking in favor of a high goodness-of-fit (Cohen, 1988). The model for dependent variable AI leads to slightly better descriptive power than the model with AB as the dependent variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	177,069	8	22,134	41,652	,000[b]
	Residual	163,137	307	,531		
	Total	340,207	315			

a. Dependent Variable: AI

b. Predictors: (Constant), IB2, TR1, RAT, UB, RB, VB, CP, RAH

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	175,770	8	21,971	35,555	,000[b]
	Residual	189,713	307	,618		
	Total	365,482	315			

a. Dependent Variable: AB

b. Predictors: (Constant), IB2, TR1, RAT, UB, RB, VB, CP, RAH

Table 14: Results of ANOVA analysis.

The results of ANOVA (Table 14) show that the independent variables predict statistically significant AI, with $F(8, 307) = 41{,}652$; $p < 0{,}001$ and AB with $F(8, 307) = 35{,}555$; $p < 0{,}001$. The overall model is significant, since the p-value is lower than the determined alpha ($\alpha = 0{,}05$).

4 Results

4.1 Results from Multiple Linear Regression

Coefficients – Dependent Variable: Adoption Intention

Model	1		2		3	
	β	Sig.	β	Sig.	β	Sig.
RA- Health Benefits			,274	,001	,212	,005
RA - Taste			-,158	,000	-,141	,030
Personal Compatibility			,381	,017	,365	,000
Trialability			,191	,000	,191	,000
Usage Barrier			,003	,000	,039	,409
Value Barrier			-,167	,953	-,179	,003
Risk Barrier			,010	,007	,013	,772
Image Barrier			-,115	,815	-,138	,005
Health Motivation	-,005	,953			-,046	,446
Food Neophobia	-,282	,003			-,090	,203
Innovativeness	,285	,000			,161	,004
Gender	-,118	,293			,026	,757
Age	,041	,356			,057	,080
Educational Level	-,013	,762			-,053	,099
Constant	2,847	,000	1,684	,001	1,660	,012
R-squared		,147		,520		,556
Adjusted R-squared		,130		,508		,535

Coefficients – Dependent Variable: Adoption Behavior

Model	1		2		3	
	β	Sig.	β	Sig.	β	Sig.
RA- Health Benefits			,274	,000	,261	,000
RA - Taste			-,158	,000	-,236	,000
Personal Compatibility			,381	,000	,318	,000
Trialability			,191	,000	,155	,000
Usage Barrier			,003	,082	-,001	,979
Value Barrier			-,167	,933	,008	,891
Risk Barrier			,010	,391	,031	,470
Image Barrier			-,115	,035	-,153	,002
Health Motivation	-,153	,044			,110	,070

Food Neophobia	-,459	,000			-,279	,000
Innovativeness	,326	,000			,215	,000
Gender	-,189	,077			-,101	,232
Age	,122	,004			,129	,000
Educational Level	,000	,993			-,028	,385
Constant	2,116	,000	1,358	,013	,963	,142
R-squared		,288		,481		,591
Adjusted R-squared		,274		,467		,572

Table 15: Results of multiple linear regression - significance and coefficients.

Relative advantage - health benefits, *relative advantage - taste*, *personal compatibility*, *trialability*, *value barrier*, and *image barrier* are significant variables in predicting *adoption intention*.

Relative advantage - health benefits, *relative advantage - taste*, *personal compatibility*, *trialability*, and *image barrier* are significant variables in predicting *adoption behavior*.

Usage barrier and *risk barrier* are not significant factors in both models.

Furthermore, as indicated by the β-coefficient, looking at the reasons for adoption the highest influence on *adoption intention* can be found, with *personal compatibility* ($\beta_3 = 0{,}381$), followed by *relative advantage - health benefits* ($\beta_1 = 0{,}274$) and *trialability* ($\beta_4 = 0{,}191$). Looking at barriers, the *value barrier* ($\beta_6 = -0{,}167$) has the strongest influence followed by the *image barrier* ($\beta_8 = -0{,}115$). Furthermore, other than hypothesized, *relative advantage - taste* also has a significant negative influence ($\beta_2 = -0{,}158$).

As a result, the multiple regression equations are:

$$AI = 1{,}684 + 0{,}274\ RAH - 0{,}158\ RAT + 0{,}381\ CP + 0{,}191\ TR - 0{,}167\ VB - 0{,}115\ IB$$

$$AB = 1{,}358 + 0{,}381\ RAH - 0{,}284\ RAT + 0{,}342\ CP + 0{,}182\ TR - 0{,}114\ IB$$

In conclusion, six of the proposed factors are significant in explaining adoption intention of new functional food products on the German market.

H1a, H2, H3, H5, and H7 are supported, while H1b, H4, and H6 are not supported.

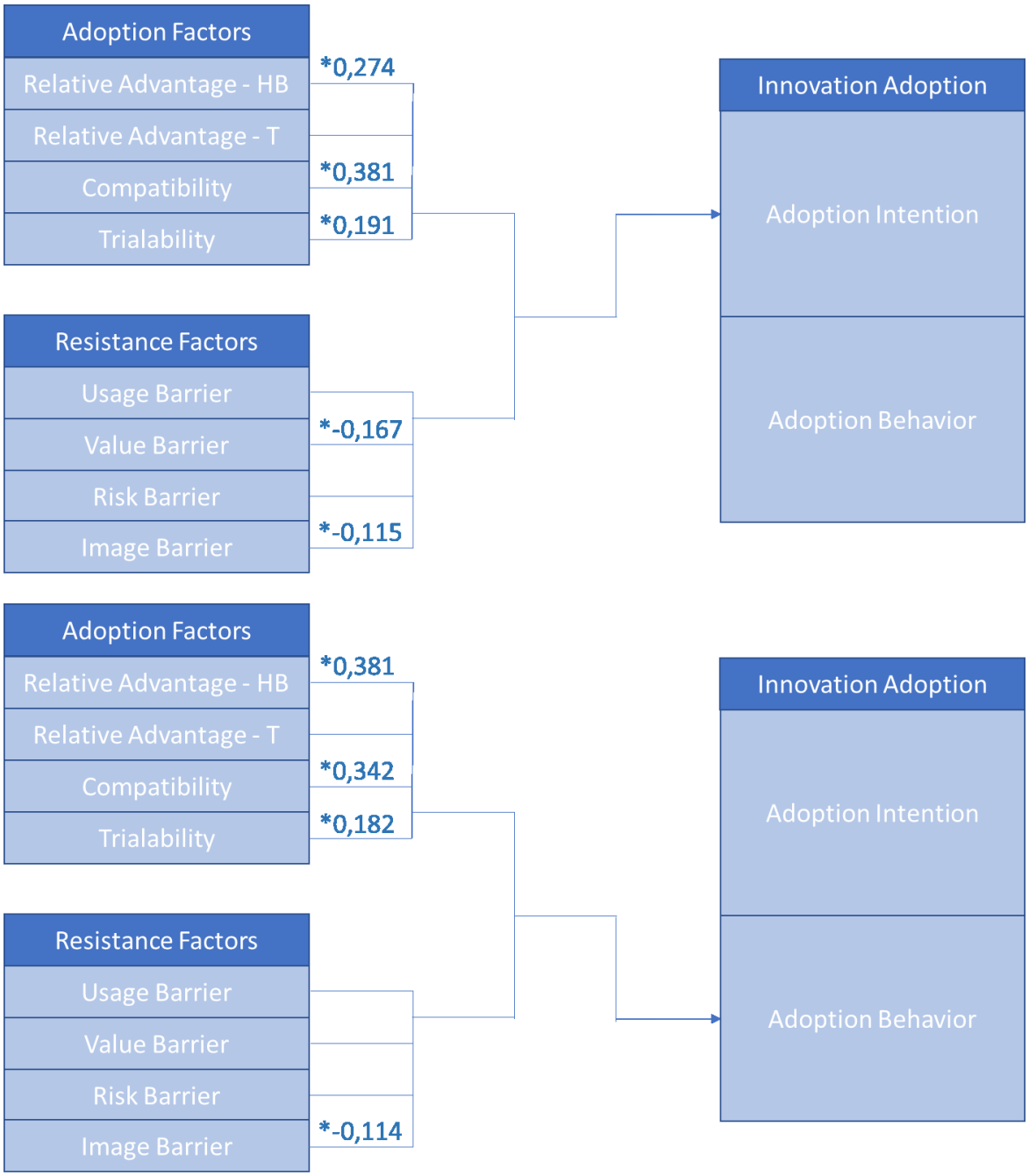

Figure 9: Overview of hypothesis testing.

Looking at the control variables, in the model with *adoption intention* as the dependent variable, the only significant variable is *innovativeness*. It positively influences adoption intention with a β-coefficient of 0,161.

Concerning the model with *adoption behavior* as dependent variable, *age* and *food neophobia* are additional significant variables next to *innovativeness*. While higher age positively influences *adoption behavior* with a β-coefficient of 0,129, *food neophobia* has a negative influence on *adoption behavior* with β = -0,279. The influence of *innovativeness* is higher than those of *age* for both dependent variables.

4.2 Results of the Case Experiment

Participants who intend to buy *FocusGum* score higher on every adoption factor, while scoring lower on every barrier to adoption. Most notably, they perceived *health benefit* and *trialability* as a much stronger factor influencing their adoption. Whereas the participants who do not intend to buy *FocusGum* score much higher on every barrier, the strongest being the *value barrier*, followed by the *image barrier*.

Comparing of Grouped Means

Intention to Adopt FocusGum		RA – Health Benefits	RA – Taste	Compa-tibility	Trial-ability	Usage Barrier	Value Barrier	Risk Barrier	Image Barrier
Yes	N	183	183	183	183	183	183	183	183
	Mean	4,39	4,15	3,95	3,95	1,95	3,16	2,09	2,07
	Std. Deviation	,754	,760	,888	1,073	1,101	,986	1,031	1,046
No	N	133	133	133	133	133	133	133	133
	Mean	4,03	4,10	3,74	3,47	2,35	3,92	2,41	2,74
	Std. Deviation	1,073	,912	1,079	1,158	1,361	,946	1,156	1,092
Total	N	316	316	316	316	316	316	316	316
	Mean	4,24	4,13	3,86	3,74	2,12	3,48	2,23	2,35
	Std. Deviation	,918	,826	,977	1,133	1,231	1,037	1,095	1,116

Table 16: Results of the case experiment - closed questions.

This trend can be also observed when comparing the rankings that the participants produced. They indicate for both groups that RAH, followed by RAT, are the most important factors for adoption, and that VB, followed by RB, are the most important barriers. The frequency cross-tables can be found in the appendix table A4.

An opportunity to name additional factors was included, in an attempt to find more influencing factors in an exploratory way. Out of the 316 responses, 60 participants named additional factors for adoption, and 22 named barriers. An overview for better evaluation can be found in Table 17, all answers in word format can be found in the appendix.

Price has been an issue of major concern in this analysis. Following it, the most frequently named factors – *proven* and *noticeable effect*, *naturalness*, and *availability* - are further discussed in the next chapter.

Category of factor named	Count
Price	19
Proven effect	8
Naturalness/ organic/ vegan	7
Availablitiy (in shops)	7
Noticable effect	6
Ease of use	5
Design/ packaging	5
Sugar free	3
Complete information	2
Trust in supplier (adoption)	2
Lack of trust in industry (resistance)	1
Reviews from other customers	1
Special gum issues	10

Table 17: Results of the case experiment - open questions.

Finally, there was an offer to immediately buy/ pre-order the presented product on the next survey page, after giving answers to all the questions on adoption factors and *adoption intention*. Out of the 316 participants, 183 indicated that they intend to buy *FocusGum*, which equates to 57,9%. Of these 183 respondents, who said that they intent to buy the product, 36,6 % actually did buy the product spontaneously. In total numbers, 67 participants pre-ordered *FocusGum*, with 93 packages pre-ordered in total, since some participants ordered more than one unit.

5 Discussion and Implications

Functional food innovations are steadily launched but meet significant market-related and regulatory boundaries. Since research on this is scarce, the study aims to examine the influence of different innovation characteristics and barriers on *innovation adoption*. The results for the whole conceptual model, each factor and hypotheses, as well as additional findings, are discussed in this chapter.

5.1 Discussion of the Proposed Factors and their Influence in the Model

To answer the research question of which factors influence the innovation adoption of functional food product innovations among German consumers, eight adoption and resistance factors have been tested.

Out of the four tested adoption factors, three are significant in the model. *Relative advantage* due to *health benefits* had a large, positive, significant influence on *innovation adoption* of functional food products. This result is also confirmed by the case experiment, fitting with the prior deliberations on the importance of *health benefits* as the foremost, inherit reason for buying functional food compared to conventional food, which is similar to previous findings in functional food research (L. Frewer et al., 2003; Siegrist et al., 2015; Urala & Lähteenmäki, 2004, 2007). Thus, the factor could potentially serve as a benchmark when looking at other factors. Although *health benefits* have been shown to be an important factor, they can barely be communicated to customers on European markets due to the *health claims regulation* (Siegrist et al., 2015). For functional food product innovations, it might be beneficial to elaborate on their *health benefits* as much as possible within the permitted extent, while simultaneously focusing on other factors which might serve as a viable alternative to support the consumers' adoption decision process, or help to dissolve influential barriers. Two of such positively influencing factors have been found to be *personal compatibility* and *trialability*.

According to the study's results for the factor *personal compatibility*, whether the functional food product innovation is perceived as being compatible with the consumer's own personal values and beliefs matters to a great extent. The coefficient is nearly as high as that of *health benefits* in the model with *adoption behavior*, and it even exceeds it in the model with *adoption intention*. Interestingly, looking at the Pearson correlation, it can even be recognized that both independent variables *personal compatibility* and *relative advantage* due to *health benefits*, are considerably correlated to each other with r = 0,66. This high correlation of *relative advantage* and *compatibility* is a phenomenon that has been reported in previous studies, as well (Arts et al., 2011; Karahanna, Straub, & Chervany, 1999; Tornatzky & Klein, 1982). As a result, it could be said that it is hard to convince people to adopt products that do not match their personal values – and this might be especially true in the field of functional food. The vast majority of survey participants scored high on *health motivation* (mean: $\mu = 4{,}01$), but functional foods might not be the right approach for everyone. As a result, an emphasis should be put on communicating any values the product is able to invoke, and which consumer beliefs they will match with. Additionally, as in previous studies, the results show that consumers' *health motivation* is a significant variable in the model, positively influencing the acceptance of functional food products (Siegrist et al., 2015).

The third factor that has been analyzed to have positive influence on *innovation adoption* is *trialability*. Although *trialability* is one of the classic adoption factors identified by Rogers (1962), its notion has not been properly addressed yet in acceptance studies on functional food products. The results of the current study, however, suggest that *trialability* is one of the factors that significantly influence *innovation adoption*. The strengths of its positive effect ranks directly after those of *health benefits* and *personal compatibility*, and its positive effect is stronger than any negative effect among the barriers. Whilst participants indicated a strong importance of the ability of try a product before purchase (mean TR1: $\mu = 3,81$), they have no idea how they actually could try it (mean TR2: $\mu = 2,51$). The finding reveals that this may currently be a shortcoming in business practice, that there either is no possibility to try new products, or the possibility to do so is badly communicated to the consumers. Based on the findings of this study, it is suggested that suppliers, as well as researchers, should take a closer look at *trialability* of new functional food products. The case experiment delivered some additional findings to support the prior argumentation. Participants who stated their adoption intent but did not perform *adoption behavior* when given the chance immediately after, most commonly gave as a reason that they want to try the product prior to purchase. Thus, it could be proposed that the possibility to try the product innovation might close the gap between *adoption intention* and *behavior*. Out of the factors dealt with in this study, *trialability* sticks out as having great importance, while not having been directly covered by previous research.

The forth adoption factor *relative advantage due to taste*, was found to be significant, but had a negative influence for both *adoption intention* and *adoption behavior*. This is contrary to previous findings that attributed *taste* to be an important factor for functional food acceptance (Lähteenmäki, 2013; Siegrist et al., 2015; Verbeke, 2005). Other than hypothesized, the β-coefficients show a negative influence (AI: $\beta_2 = - 0,158$; AB: $\beta_2 = - 0,284$). This poses the question of whether *taste* should be included as a barrier to adoption, rather than a positive influence. As shown in a study of Siegrist, added health components in new food products could generate negative expectations of the *taste* (Siegrist et al., 2015). The results for RAT1 and RAT2 reveal that for new functional foods, 69%[5] of participating consumers are not willing to compromise *taste* for *health benefits*, whilst new functional foods are acceptable to 76%[6] if they taste good. This is the same tendency as previous research of Verbeke (2005) showed. The low level of willingness to compromise *taste* for *health benefits* is especially salient looking at the high level of *health motivation* among the participants (mean HM: $\mu = 4,01$; only 4,4% of the sample indicated no health motivation). Drawing from the analyzed data, it might seem obvious that *taste* is an influential factor when it comes to the adoption of new functional foods, but the exact parameters of the effect remain to be re-investigated in further research.

When looking at the resistance factors, the *value barrier* and *image barrier* had significant influence in the model, while *usage barrier* and *risk barrier* do not.

The value barrier represents the strongest significant barrier to *adoption intention* in the model. The importance of *price* is also supported by the case experiment, with *price* being the barrier with the most importance (mean: $\mu = 3,48$), and ranked as barrier number one by 53% of the participants[7], in

[5] When asked if functional foods are acceptable for them even if they taste worse than their conventional food equivalent, 25,3% strongly disagreed, 43,7% rather disagreed and another 15,5% were neutral to this question.
[6] Only for 8,3%, functional foods are strongly or rather not acceptable even if they taste good.
[7] Of the sample, 308 respondents answered this question, 53% of which ranked the value barrier at number one, and 77% at number one or two. The absolute numbers can be found in the appendix.

addition to being the most frequently mentioned barrier in the open questions. Consumers seem to put a high importance on *price* and are not willing to compromise on this point, when an unfavorable price to value relation is perceived – a similar finding as reported in previous studies (Siegrist et al., 2015; Urala & Lähteenmäki, 2003; Verbeke, 2005). With 10,4%, only a minor part of the sample stated that new functional foods are not too expensive compared to their claimed benefits. This might imply that the price premium which suppliers can achieve with functional foods, compared to conventional foods, could be much lower than expected, as has also been suggested by previous research (J. A. Bower et al., 2003). Previous studies came to the conclusion that consumers are in general highly loss-averse when it comes to innovation adoption, explained by a higher valuation of *perceived costs* than of *perceived benefits* (Gourville, 2006). This notion can at most be partly followed in this research, since there is a high, significant, negative effect of the *value barrier*, which is however outweighed by the positive influence of perceived *health benefits*. Even though the *value barrier* is the strongest barrier in the adoption intention model, the results show that the significance of the *value barrier* vanishes when it comes to actual *adoption behavior*. This might imply that there are no more doubts related to *price* once the innovation is adopted.

Next to the *value barrier*, the *image barrier* due to lack of *trust* is the second largest inhibitor that is significantly related to *innovation adoption* of functional food product innovations. The direction of the effect is negative, with a moderately-sized effect on *innovation adoption* (AI: β_8 = -0,115; AB: β_8 = -0,115). Looking at all the factors, the β-coefficient of the *image barrier* is the only one staying constant throughout both phases of the adoption process. Similar to the results of previous studies, there seems to be some distrust in the claims made by the suppliers, which is present even after adopting the innovation, as evidenced by the significant and similar effect of IB2 on *adoption behavior* (L. J. Frewer et al., 1996; Siegrist et al., 2015; Urala & Lähteenmäki, 2003). Other than shown by Siegrist et al. (2015), the *trust* in the suppliers has not been found to be a significant factor. Therefore, it could be advisable to suppliers to concentrate less on building *trust* in their company, and instead to eliminate everything that could potentially violate the *trust* in the claims they make. This notion is also supported by the participants' call for effects to be proven, as seen in the responses to the open questions of the case experiment.

For the other two barriers – the *usage barrier* and the *risk barrier* – no significant influence on *innovation adoption* has been found. The insignificance of the *risk barrier* in explaining *innovation adoption* in the model is also supported by answers to the closed questions in the case experiment (mean: μ = 2,23). These results are in contrast to what some previous studies have suggested for factors similar to *physical risk* (Siegrist, 2008; Siegrist et al., 2007; Siró et al., 2008; Urala & Lähteenmäki, 2007). Beside this, looking at the ranking, the *risk barrier* is the second most important resistance factor, providing some contrary evidence.[8] Independent of the *risk barrier*, *food neophobia* was found to be a significant variable negatively influencing *adoption behavior* when added as a control variable to the model. This is in line with previous research which showed that consumers that score higher on food neophobia are less willing to buy functional foods (Siegrist, 2008; Urala & Lähteenmäki, 2007). The hypothesis of a *risk barrier* due to *physical risk* has been rejected in this study, but there might still be a chance for other characteristics of risk to be present in the adoption of functional food innovation, such as *functional risk*, *social risk*, or *economical risk*, providing potential for further investigation.

[8] The related frequency analysis can be found in the appendix table A4.

Similar to the results of the *risk barrier*, the *usage barrier* through *habit change* has not been found to be a factor inhibiting *innovation adoption* in the model. When participants were asked to actively state their opinion on the topic, no significant effect of the expected habitual change and the *usage barrier* can be found. Nevertheless, it is proposed that it is still possible that there is passive resistance or refusal at a later stage, due to *habit change*, as also shown in recent research (Labrecque et al., 2017).

In conclusion, out of the eight factors, six are investigated which are found to have significant influence on *innovation adoption*, while the effect sizes for some of these factors differ between *adoption intention* and *adoption behavior*.

The Influence on Adoption Intention and Adoption Behavior

When comparing the results from the multiple linear regression with dependent variable *adoption intention* to the one with *adoption behavior*, it can be determined that they are relatively similar. Seven out of the eight analyzed factors have a similar p-value and β-coefficient in both models. The exception to this is the *value barrier*, which is significant for *adoption intention* but insignificant for *adoption behavior*.

Adoption intention and *adoption behavior* are well correlated with a correlation coefficient of r = 0,74. As a point of comparison, a meta-analysis conducted by Sheppard et al. (1988) revealed a correlation coefficient of r = 0,53 between *intention* and *behavior*.

Looking at the case experiment, 183 participants intended to adopt the presented product innovation *FocusGum*, of which 67 actually bought it directly from the survey, thereby demonstrating *adoption behavior*. Approximately one third of participants were willing to act directly on their *intention*.

Drawing from the results, in the field of functional food, a consumers' *adoption intention* might not be a perfect, but a satisfying predictor of *adoption behavior*. Further research could provide guidance on how to judge stated *adoption intention* and possibly replicate this *adoption behavior*, where one third of customers who intend to adopt, actually do.

Additional Factors derived from Open Questions

Proven and Noticed Effect

Effects, distinguished into *proven effect* and *noticed effect*, have together been most frequently pointed out by the participants as important factors. Although these *effects* might also simply be attributed to *health benefit*, it might be worth taking a closer look at them, as they have been named as additional factors quite often. Both *proven* and *noticed effects* however, are hard to deliver on in practice. Even if a scientific study is conducted for approval of a functional foods effect, it can hardly be expected that the consumer gets to know about it, because suppliers of functional foods are not allowed to mention the studies' results, or use it for marketing purposes, which would have to be approved through a difficult process by the *EFSA*. Concerning noticed effect, it should be mentioned

that the amount of allowed active substances in functional food are regulated by law. For the most part, it is not possible to include amounts that would result in immediately noticeable effects. The effects of functional foods can not therefore be compared to those of medicine. Resulting from all this might be a presence of consumers' misperception of what functional foods are capable of offering, which is worth studying in further research.

Naturalness

The shift to natural, organic, and vegan products is a major trend among foods in general, which affects functional foods, as well (Julian Mellentin, 2016). There are a lot of positive aspects attributed to those products, including the notion that they are tastier and healthier than their conventional food alternative (Lockie, Lyons, Lawrence & Grice, 2004; Siegrist, 2008). Since both perceived *health benefit*s and *taste* have proven to be influential factors for adoption, *naturalness* appears relevant, because it influences these two. Previous research came to the conclusion that consumers prefer food that is perceived as natural (Rozin et al., 2004), and might become skeptical if attributes like added ingredients, or genetical modification are present, decreasing the perceived *naturalness* (Lähteenmäki, 2013). For all these reasons, it might be worth including *naturalness* as a factor in further research, and examining whether there is an additional effect which can be distinguished from those of *health benefits* and *taste*.

Availability in Shops

As elaborated on in the Problem Context chapter, having food innovations be available in classical retail immediately after launch is hard to accomplish. Online sales might serve as a good alternative during the initial launch phase. Two of the tested factors in this study's model might influence this construct of *availability*: *trust* and *trialability*. Aspects which may in fact deter potential consumers from purchasing food products online include the lack of being able to experience -to feel, smell, and maybe taste- the product prior to purchasing, as well as a difficulty to generate *trust* for the offering, when done solely via online channels. It might be interesting to analyse whether *availability* can stand as a sole independent variable on *innovation adoption*, or whether it is mainly explained by *trust* and *trialability* already.

Despite the fact that some participants did not want to adopt the product when available only on the internet, it is proposed that in general, online channels are a practical way to launch and test new product innovations, ensuring decent market coverage right from the start. Online sales might also enable suppliers to test new products with customers on a smaller budget, providing sufficient opportunities for young startup companies to reach a *critical mass of adoption* of new innovative functional food products. Whereas classical food and staple products have not become fully suitable for online-purchase and delivery in Germany yet, functional foods are a special case. Due to their usually condensed form, and higher pricing, the design of functional foods is naturally more suited for online delivery, providing the opportunity for a company to achieve its first adopted products.

5.2 Theoretical Implications for Research

This study contributes to the *innovation adoption* literature by assessing Rogers' (1962) perceived *innovation characteristics* in the field of functional food. Similarly, the study contributes to the *innovation resistance* literature by examining the influence of different barriers as proposed by Ram & Sheth (1989) to functional food *innovation adoption*. Both research streams are integrated into one model, which is why the study contributes to the notion evolving in adoption research, to integrate adoption factors as well as resistance factors into one model. Further research should look at how to extend and verify the model's approach. Attention should be directed towards *trialability* as a factor, as it could be shown to be very influential for functional food *innovation adoption*, but is scarcely researched so far. Additionally, there may well be additional variables to test, such as *tradition barrier*, *observability*, or *relative advantage* due to *naturalness*.

Furthermore, this study made a distinction between two *innovation adoption* stages – *adoption intention* and *adoption behavior*. Whilst *adoption intention* served as a satisfying predictor for most of the factors, some, such as the *value barrier*, yield fairly different results when applied to *adoption behavior*, making it a distinction worth making. Further research should try to incorporate such considerations, or find even better ways to account for *innovation adoption* being a decision process.

An additional case experiment was successfully run in this study, making the recommendation to further research to experimentally analyze the phenomenon of why some consumers intend to, but do not actually adopt. This could contribute to finding an answer to closing the gap between *intention* and *behavior* in the field of product *innovation adoption*.

5.3 Practical Implications for Business Practice

For business practice in the field of functional food, it is beyond question that ways must be found to launch and promote new product innovations even within the restrictions of the highly regulated German market in regards to health-claims. Gaining an understanding of the factors influencing *innovation adoption* is an important step towards this goal in business practice.

This study contributes to the matter in the way that it has analyzed the importance of several other factors next to the central variable of *health benefits*, thereby serving as an opportunity to make use of factors relevant to the consumer, besides those that might be affected by restrictions. Concerning this, the study revealed important factors that suppliers and marketeers should take a look at, to more successfully establish new products.

Drawing from the results, the most influential factor is the perceived compatibility with the consumers' own *personal values*. Although this is a fact that can hardly be changed on the side of the consumer, it can be taken into account by marketing, by addressing the respective customer segments that are more likely to fit the new product value proposition. This speaks in favor of engaging heavily in grouping and segmenting consumers, when aiming to address potential customers with a personalized message

Furthermore, it might be fruitful to direct efforts towards enhancing the *trialability* of the offering, as it has been analyzed as an important factor for consumers, as well. Obvious ways to address this matter in business practice and marketing would include an increase in practices such as distribution of give-away trial packs, implementation of a booth to try products at, or money back guarantees. Those measures are already in use but could be enhanced nevertheless. In some instances, trial before purchase might be a challenging prospect, for example when products are purchased online. It might be interesting to investigate whether a similar effect can be achieved by getting references from friends that have tried it, to support the decision-making process with information.

Additionally, Suppliers of new functional food product innovations should care about the *taste* of their product, as well as find the right way to communicate this to consumers. This is where an interplay of the different factors comes into being: offering a free trial could dissolve wrong perceptions about the *taste* immediately.

In terms of the required habit change, this study wants to draw attention to the fact that there is a major trend towards *convenience* in food, which has become a more and more important issue for food consumption (Brunner, van der Horst, & Siegrist, 2010). Generally speaking, people might be more willing to replace an existing habit if the new one is perceived as being more convenient. It might therefore be advisable to include such considerations when developing new functional food products, next to pre-testing usability and rejection through habit slips, with a selected group of consumers before launch.

The results should also raise awareness to the fact that consumers weigh factors differently when expressing *adoption intention*, compared to showing *adoption behavior*. Practitioners should be aware that *adoption intention* can predict behavior only to a certain extent. In the included case experiment, approximately one third of the consumers who stated *adoption intention* actually adopted.

Recommendations for suppliers and marketeers to positively influence the adoption when launching a new functional food product innovation, as implied by the study's results, could be summarized as follows:

Build a product that fulfills a customer need and solves their problem or "jobs-to-be-done" (Christensen, Anthony, Berstell, & Nitterhouse, 2007). Develop the most understandable and trustworthy claims that best describe the functional food's *health benefits* and *effect*, remaining within the boundaries of the *health claims regulation*. Make sure that customers do not have to compromise much on *taste* or *convenience*, compared to their current solution. Eradicate everything that could lead to a wrong perception of the *taste*, or the price-to-value relation in consumers' minds. Engage in building personas and customer segments to get an understanding about the potential first adopters, fitting to the values the product conveys. Test the product with customers by selling the minimal viable product to them. Try to collect as much feedback as possible, to adjust and iterate the product. Before making it available across retail chains, launch the product via online channels, since this is an easy and cost-efficient way to distribute to a large area, find first paying customers and get immediate feedback from product reviews. For consumers who intend to adopt, offer and communicate ways to try the product out, so that they may convince themselves of the offering. Build *trust* with the consumers by delivering on promises made, and have integrity in your customer relationships, as it can positively influence their *innovation adoption* of further product innovations, too.

6 Limitations and Further Research

The study could serve as a point of reference and inducement for further research in the field of functional food adoption. Nevertheless, due to the scope of the study being a thesis project, certain limitations arise.

First of all, the results are limited to consumers on the German market. As previous research has shown, the German market might be a special case for functional food product acceptance (for an example, see Siegrist et al., 2015), the results or even the model design might not be applicable to other cultures and countries. Possible opportunities for further research would be to shed light on several other countries or cultures, and to provide a point of comparison between those. It might be possible that the German market for functional foods is quite different from the rest of the world, opening up some interesting research questions. Furthermore, there might be other demographic factors worth including, such as *income*, and *family size*.

Another limitation is the fact that the sample does not match the population of German consumers in terms of *age* and *education* distribution. Most participants of this study are young and well educated, potentially leading to certain tendencies among the results. For both demographic factors, it might be relevant to further research to distinguish between different groups of *age* and *education* when looking at adoption factors and barriers.

Similarly, additional adoption and resistance factors should be tested, which were excluded from this study due to limited scope. When doing so, it could be useful to apply other quantitative methods, namely a factor analysis, to find independent latent variables, and to confirm the construct validity of the scales. More items should be used for each variable to enhance the scale reliability.

The general downfalls of using questionnaires for data collection come into play, as well. There is a high non-response error, it is hard to evaluate the participants' understanding, interpretation, conscientiousness and biases of the topic, and it can often be said that respondents who return surveys represent extremes of the population, giving what are known as skewed responses. Further studies should apply other research methods, also.

Additionally, acceptance of food can be influenced by affective and less recognizable reasons, which can hardly be measured by asking for self-judgement about beliefs and opinions in a questionnaire. In line with that, *passive resistance* to innovations might be an interesting topic for further studies, as also evidenced by recent literature, the *usage barrier* being described as "*habit slips*", for example (Labrecque et al., 2017).

Another point of critique could be that the study utilizes a cross-sectional approach, presenting only a snapshot of one point in time. *Innovation adoption*, however, can be seen as a process over time. In line with previous research, this study has aimed to account for this in a way where two main process stages are distinguished: *adoption intention*, and *adoption behavior* (Arts et al., 2011). Further studies could more clearly account for the issue of *innovation adoption* being a process, by choosing a longitudinal, process-oriented approach and analyzing possible dynamic effects.

The sample size, in total, is quite sufficient for the purposes of this study, nevertheless the sample size should be larger to draw sound inferences about a population as big as all German customers. A larger sample size might be interesting for a subsequent study, in combination with a more even

distribution of *age* and *education*. Although reliability and validity considerations have been addressed, the external validity of the measures should be checked by further studies.

Another limitation concerns the type of innovation. The adoption and resistance factors are adapted to the special context of functional food product innovation. Thus, the model, as well as the results and implications, might not be applicable to the adoption of services, or even other product categories. Nevertheless, the study contributes to the fairly new approach of combining adoption and resistance factors in a single model, which theoretical foundation can be as well used for further studies for other types of innovation.

A possible bias might have occurred as a result of the consumers that the survey has been distributed to. 128 of the responses are from consumers that came from *Neuronade's* e-mail list, who have potentially bought a functional food product from *Neuronade* before. It is therefore likely that these participants can be thought of as having *trust* in the supplier and are willing to try new functional food products in general. Another 128 responses came from the extended network of the author, for which it can be assumed that a certain number of participants at least knew about products by *Neuronade* beforehand.

Since the case experiment was done using a single innovation only, the answers are essentially related to this special type of product. This is also evidenced by the number of factors concerning the product category of gums, which were mentioned in response to the open questions. The applicability of results to other innovations is therefore limited.

Additionally, the results in general might serve as an interesting cause to further investigate the topic as an exploratory research project, using a qualitative approach and methods such as semi-structured in-depth interviews or focus group discussions, to reveal new insight into the phenomenon.

The theoretical discourse, as well as the results of this study, speak in favor of a call for an updated innovation adoption model, including adoption factors alongside resistance factors, as well as socio-demographic and psychographic factors, with both *adoption intention* and actual *adoption behavior* as dependent variables.

In conclusion, it can be said that this study contributes to the existing literature and business practice, leaves space for development of extended studies into different directions and provides valuable indications for further research.

7 Conclusion

Innovating enables companies to open up new markets and satisfy new customer demands, as well as gain competitive advantage and differentiation with respect to competitors. Therefore, fostering innovation in the field of functional food is relevant to companies as well as consumers.

The German market poses a special case because of its consumers' beliefs and governmental regulations, which make suppliers face challenges when launching new functional food product innovations. The current market situation could lead to a situation where innovation in this field is suppressed. "Companies may be hesitant to work on such products because it may not be feasible to market these items to consumers in a way that they understand the claimed health benefits" (Siegrist et al., 2015, p. 92).

To provide knowledge and new opportunities in regard to this matter, the research question this study aims to answer is: Which factors influence the innovation adoption of functional food product innovations among German consumers?

To do so, theory from innovation adoption, as well as innovation resistance literature has been applied to build a conceptual framework. The factors have been drawn from the literature on adoption, and from functional food literature. The analysis of primary data of 316 German consumers, collected by means of an online survey, revealed that there is a positive influence on the *innovation adoption* of a new functional product if it is perceived as having a *relative advantage* due to *health benefits*, as well as being *triable* before purchase and *compatible* with the consumers' values. On the other hand, a perceived unfavorable price to value relation, bad taste, and distrust towards the claims made by the suppliers, might impede the intention to adopt the innovation. A barrier through *habit change* and *physical risk* has shown not to be a significant predictor of the *intention* and *behavior* to adopt.

The results suggest that even in *health claims* regulated markets, there might be a good chance for suppliers to successfully realize adoption of their new product innovation, by focusing efforts on these influential factors, next to *health benefits*, as well. The most notable finding made for the field of functional food might be the importance of *trialability* for the consumers, as well as the fact that the extent of the effect differs for almost all factors amongst the two stages of *innovation adoption*.

Research might find it most valuable to take away three main conclusions from the study: Firstly, evidence from innovation adoption models can be applied in the field of functional foods and used for a sound model. Secondly, both adoption and resistance factors for functional food innovation adoption can be integrated into one conceptual model. Thirdly, it is beneficial to distinguish *innovation adoption* into *intention* and *behavior*, and to look at both stages of the innovation adoption process. Moreover, it can be noted that a case experiment provided interesting additional results and evidence for the factors. In this regard, the study has integrated a quite unique approach, since there are not many studies in existence so far, which experimentally confront the participants with a real buying decision in order to test *adoption behavior*.

For suppliers, several practical implications can be taken from the study to successfully market new functional food products to German consumers. The most successful strategy will be to provide the most possible value to the consumers' needs, to utilize the maximum range inside the regulatory

borders to communicate advantages through *health benefits*, to communicate inherit values to a segmented group of consumers, to eliminate their perceived barriers of *price*, *taste*, and *trust*, and to give the opportunity to try out the innovation and become convinced by the performance of the offering.

After years of poor modern diets, featuring highly processed, sugar- and fat-loading convenience food, functional foods can become one of the major contributors to bringing back well-balanced diets and a healthy society. There is a constant development of increasingly refined products, addressing health issues more precisely, making beloved foods available once again for those who suffer from food allergies, being environmentally friendly and promoting more natural and healthy ingredients. By applying the study's insights, chances might increase for a company to overcome current market barriers, allowing for steady fostering of superior innovation in the trending field of functional foods, and for bringing substantial value to companies as well as consumers.

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9 Appendix

9.1 Survey

Survey Introduction

Survey Functional Food Innovations

Thank you for taking the time to participate in this research study conducted by Florian Mack - Master Student at University of Twente (Netherlands) and Technical University of Berlin (Germany).

The study aims to gather insight into reasons for and against adopting new functional food products. For examples of functional foods in this context, you can think of conventional food products with added benefits for your health – for example milk products enriched with probiotics to strengthen the immune system and prevent a cold, breakfast cereals with added fiber and excluded gluten, or a soft-drink supplement containing micronutrients to reduce lack of concentration and ensure good focus (e.g. Neuronade).
Products are counted as new/ innovative, if you perceive them as being new.

Your answers will help the research on functional food innovations, as well as Neuronade and other startups, to understand how to develop better products.

The survey is divided into 3 Parts.
Completing the whole survey will take approx. 7 minutes.
After finishing, you will receive a personal voucher code for all Neuronade products and Boxes on Amazon.de, and the chance to win a 100€ Neuronade pack, if you'd like.

For possible questions or remarks, feel free to contact me via email: f.mack@student.utwente.nl

Please answer all of the questions - there are no wrong answers! If you are unsure, spontaneously give the answer that feels best at that moment.

Thank You very much for your time and support! :)

Part 1/3: General opinion on functional food product innovations

Please state your opinion on the following questions.

In my opinion, **new functional food products ...**

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
… have a favorable health benefit over their conventional food equivalent.	○	○	○	○	○
… will have the health benefits they claim to have.	○	○	○	○	○
… would make it easier to get all the nutrients I need for a healthy diet.	○	○	○	○	○
… do not offer any advantage compared to other products that meet similar needs.	○	○	○	○	○
… are acceptable for me if they taste good.	○	○	○	○	○
… are acceptable for me, even if they taste worse than their conventional food alternative.	○	○	○	○	○
… are compatible with my current diet and products I'm currently using.	○	○	○	○	○
… using them would be in line with my own personal values.	○	○	○	○	○
It is important that I can try new functional foods out before purchase.	○	○	○	○	○
I know where I could go to try new functional food products.	○	○	○	○	○
Using new functional foods would require significant changes in my existing daily routines and eating habits.	○	○	○	○	○
To make use of new functional foods, I don't have to change anything I'm currently doing at home.	○	○	○	○	○
… are too expensive given their claimed health benefit.	○	○	○	○	○
… have a favorable price/quality relationship over other products that meet similar needs.	○	○	○	○	○
… can cause serious unintended negative effects to my body.	○	○	○	○	○
I'm concerned about potential physical risks associated with new functional foods.	○	○	○	○	○
I have trust in the suppliers that sell and produce new functional foods.	○	○	○	○	○
I have trust in the claims made by the suppliers of new functional foods.	○	○	○	○	○
I intend to use new functional foods in the next 12 months.	○	○	○	○	○
I intend to increase my use of new functional foods in the future.	○	○	○	○	○
I intend to include new functional foods in my diet in the future.	○	○	○	○	○
Functional foods are part of my diet.	○	○	○	○	○
I include new functional foods whenever possible and reasonable in my diet.	○	○	○	○	○
I frequently try new functional foods.	○	○	○	○	○

Part 2/3: Example functional food product innovation

You are one of the first customers to see this new functional food product innovation!

A functional chewing gum with lemon+mint taste, to promote cognitive functions and reduce stress.

The effect on the brain is scientifically proven, the formula is created by nutrition experts, and the quality of the product is checked by an independent institute.

The gums serve the daily nutrients of Vitamin B5, B7 and B12, and Zink. Additionally, each gum contains 100mg of L-theanin, a nootropic substance found in green tea, Xilitol, and the conventional chewing gum basis. The product is caffeine-free, vegan, and made from natural ingredients. One pack contains **9 gums** and costs **3,95€**.

The following factors are important to me,
when I think of buying and using this new functional gum:

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
The health benefit it offers	○	○	○	○	○
The taste	○	○	○	○	○
The compatibility with my personal values	○	○	○	○	○
The ability to try the product before buying it	○	○	○	○	○

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
I think I would have to change my habits/ routines to use this product.	○	○	○	○	○
The price seems too high, compared to the value.	○	○	○	○	○
I fear the risk that it could have unintended effects on my body.	○	○	○	○	○
I don't trust the brand/ seller.	○	○	○	○	○

I intend to buy this product

- ◯ Yes
- ◯ No

Which factor is most important to you, when you think of using this new functional food product?
Please rank (using drag and drop):

- Health benefit
- Taste
- Personal compatibility
- Ability to try

Name additional factors if you like

Which factors would hold you back from buying this new functional food product?
Please rank (using drag and drop):

- Habit change
- High price
- Physical risk
- Lack of trust

Name additional factors if you'd like

You can buy the product now - pre-order FocusGum!

Buy now

A new tab will open to Neuronade.com's official online-shop. Pre-order FocusGum **via invoice**. Shipping is free and expected to be in August, together with the invoice. Please type in your order number below, and continue with the survey.

Don't buy

Here you will not use the pre-order deal and won't pre-order FocusGum. Just click "**-> weiter**" and continue with the last questions.

Type in your order number here: Your data is kept anonymous, it is just to check if an order exists

Survey Segment 3

Thanks for taking part in this little experiment!
You can tell us why you pre-ordered, or why you don't:

Now some last few questions about you:
Part 3/3: About You

What is your gender:

Female	Male	Other (please only pick when appropriate)
○	○	○

How old are you:

under 21	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	over 70
○	○	○	○	○	○	○

Your educational level (last degree, or currently pursuing)

University	Ausbildung	Abitur	Realschule	Less than Realschule
○	○	○	○	○

Please state your tendency:

	Strongly disagree	Somewhat disagree	neutral	Somewhat agree	Strongly agree
It is important to me that the food I eat on a typical day is nutritious and keeps me healthy.	○	○	○	○	○
I eat what I eat because it is healthy.	○	○	○	○	○
I am constantly sampling new and different foods.	○	○	○	○	○
I do not trust new food products.	○	○	○	○	○
I am afraid to eat foods I have never had before.	○	○	○	○	○
Concerning new products, I would generally consider myself an early adopter.	○	○	○	○	○
I must see other people using new innovations before I will consider them.	○	○	○	○	○

That's it! As soon as you finish the survey, your personal voucher code will generate. If you want to try to win the 100€-worth Neuronade pack, please enter your contact address (email, facebook..) here, to get a winnings notification:

Figure A1: The online-questionnaire used for data collection.

9.2 Survey Item Creation

Label	Survey Item	Survey Item German Translation	Survey Item Back Translation	Coding	Source
	In my opinion, new functional food products…	Meiner Meinung nach, neue funktionelle Lebensmittel ...	In my opinion, new functional food products…		
H1a - Relative Advantage – Health Benefit					
RAH1	… have a favorable health benefit over their conventional food equivalent.	... haben einen vorteilhafteren gesundheitlichen Nutzen gegenüber ihrer herkömmlichen Lebensmittel Variante.	… have a favorable health benefit compared to their conventional food equivalent.	5-Point Likert Scale	Adapted from Flight et al. (2011)
RAH2	… will have the health benefits they claim to have.	... haben den gesundheitlichen Nutzen, den sie versprechen/angeben.	… have the health benefits they claim to have.	5-Point Likert Scale	Adapted from Flight et al. (2011)
RAH3	… would make it easier to get all the nutrients I need for a healthy diet.	… machen es einfacher, alle Nährstoffe zu bekommen, die ich für eine gesunde Ernährung brauche.	… make it easier to get all the nutrients need for a healthy diet.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)
RAH4*	… do not offer any advantage compared to other products that meet similar needs.	... bieten keinen Vorteil gegenüber anderen Produkten die einen ähnlichen Bedarf decken.	… do not offer any advantage compared to other products that cover a similar demand.	5-Point Likert Scale	Adapted from Kuisma, Laukkanen, & Hiltunen (2007), as cited in Laukkanen et al. (2007)

H1b – Relative Advantage – Taste					
RAT1	… are acceptable for me if they taste good.	... sind akzeptabel für mich, wenn sie gut schmecken.	… are acceptable for me if they taste good.	5-Point Likert Scale	Verbeke (2005)
RAT2*	… are acceptable for me, even if they taste worse than their conventional food alternative.	... sind akzeptabel für mich, auch wenn sie schlechter schmecken, als ihre herkömmliche Lebensmittel Variante.	… are acceptable for me, even though they taste worse compared to their conventional food version.	5-Point Likert Scale	Verbeke (2005)
H2 – Personal Compatibility					
CP1	… are compatible with my current diet and products I'm currently using.	… sind vereinbar mit meiner Ernährung und Produkten, die ich aktuell nutze.	… are compatible with my diet and products I'm currently using.	5-Point Likert Scale	Adapted from Flight et al. (2011)
CP2	… using them would be in line with my own personal values.	Funktionelle Lebensmittel zu nutzen, stimmt mit meinen eigenen persönlichen Werten überein.	To use functional foods corresponds to my own personal values.	5-Point Likert Scale	Adapted from Claudy et al. (2015)
H3 – Trialability					
TR1	It is important that I can try new functional foods out before purchase.	Es ist wichtig, dass ich neue funktionelle Lebensmittel testen kann, bevor ich sie kaufe.	It is important to me that I can try new functional foods prior to purchase.	5-Point Likert Scale	Adapted from Flight et al. (2011), Agarwal & Prasad (1997)
TR2	I know where I could go to try new functional food products.	Ich wüsste wo und wie ich die neuen funktionellen Lebensmittel testen könnte.	I know where and how I could try the new functional food products.	5-Point Likert Scale	Adapted from Moore & Benbasat (1991)

H4 – Usage Barrier – Habits					
UB1	Using new functional foods would require significant changes in my existing daily routines and eating habits.	Funktionelle Lebensmittel zu nutzen würde wesentliche Änderungen in meinen Gewohnheiten und täglichen Routinen benötigen.	Using new functional foods would require substantial changes in my habits and daily routines.	5-Point Likert Scale	Adapted from Karahanna, Agarwal, & Angst (2006)
UB2*	To make use of new functional foods, I don't have to change anything I'm currently doing at home.	Um funktionelle Lebensmittel zu nutzen, muss ich nichts von dem ändern, was ich aktuell zuhause mache.	To use functional foods, I would have to change nothing I'm currently doing at home.	5-Point Likert Scale	Adapted from Karahanna et al. (2006)
H5 – Value Barrier – Price					
VB1	… are too expensive given their claimed health benefit.	... sind zu teuer angesichts ihrer versprochenen gesundheitlichen Nutzen.	… are too expensive considering their promised health benefits.	5-Point Likert Scale	Verbeke (2005)
VB2*	… have a favorable price/quality relationship over other products that meet similar needs.	… haben ein vorteilhaftes Preis-Qualität-Verhältnis gegenüber anderen Produkten, die einen ähnlichen Bedarf decken.	… have a favorable price-to-quality ratio compared to other products that meet similar needs.	5-Point Likert Scale	Flight et al. (2011)
H6 – Risk Barrier – Physical Risk					
RB1	… can cause serious unintended negative effects to my body.	… können ernsthafte ungewollte negative Effekte auf meinen Körper verursachen.	… can cause serious unintended negative effects to my body.	5-Point Likert Scale	Adapted from Wiedmann, Hennigs, Pankalla, Kassubek, & Seegebarth (2011)

RB2	I'm concerned about potential physical risks associated with new functional foods	Ich bin besorgt über mögliche körperliche Risiken verbunden mit neuen funktionellen Lebensmitteln.	I'm concerned about possible physical risks related to new functional foods.	5-Point Likert Scale	Adapted from Wiedmann et al. (2011)
H7 – Image Barrier – Trust					
IB1*	I have trust in the suppliers that sell and produce new functional foods	In der Regel habe ich Vertrauen in die Anbieter, die neue funktionelle Lebensmittel produzieren und vermarkten.	In general I have trust in the suppliers that produce and market new functional foods.	5-Point Likert Scale	Adapted from Siegrist (2008): Trust in institution and producers.
IB2*	I have trust in the claims made by the suppliers of new functional foods	Ich habe Vertrauen in die Werbeaussagen, die von Anbietern von neuen funktionellen Lebensmitteln gemacht werden.	I have trust in the claims made by the suppliers of new functional foods.	5-Point Likert Scale	Adapted from Siegrist (2008): Trust in claims made by institution and producers.
H8 – Adoption Intention					
AI1	I intend to use functional food in the next 12 months	Ich beabsichtige innerhalb der nächsten 12 Monate neue funktionelle Lebensmittel zu nutzen.	I intend to make use of functional foods in the next 12 months.	5-Point Likert Scale	Adapted from Claudy et al. (2015)
AI2	I intend to increase my use of new functional foods in the future.	Ich beabsichtige in Zukunft mehr neue funktionelle Lebensmittel zu nutzen.	I intend to use more new functional foods in the future.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)
AI3	I intend to include new functional foods in my diet in the future.	Ich beabsichtige in Zukunft neue funktionelle Lebensmittel in meine Ernährung einzubeziehen	In the future, I intend to include new functional foods in my diet.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)

H8 – Adoption Behavior					
AB1	Functional foods are part of my diet	Funktionelle Lebensmittel sind Teil meiner Ernährung.	Functional foods are part of my diet.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)
AB2	I include new functional foods whenever possible and reasonable in my diet.	Ich beziehe wann immer möglich und sinnvoll funktionelle Lebensmittel in meine Ernährung mit ein.	I include new functional foods in my diet whenever possible and reasonable.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)
AB3	I frequently try new functional foods.	Ich probiere immer wieder neue funktionelle Lebensmittel.	I try new functional foods on a steady basis.	5-Point Likert Scale	Adapted from Agarwal & Prasad (1997)
Innovativeness					
IN1	Concerning new products, I would generally consider myself an early adopter.	Bezüglich neuer Produkte würde ich mich selbst als "frühzeitigen Anwender" bezeichnen.	Concerning new products, I would consider myself to be an “early adopter”.	5-Point Likert Scale	Hurt, Joseph, & Cook (1977)
IN2*	I must see other people using new innovations before I will consider them.	Ich muss erst sehen wie andere Leute neue Innovationen nutzen, bevor ich sie selbst in Betracht ziehe.	I have to see how other people are using new innovations before I will consider them.	5-Point Likert Scale	Hurt et al. (1977)
Food Neophobia					
FN1*	I am constantly sampling new and different foods.	Ich probiere ständig/oft verschiedene und neue Lebensmittel.	I constantly/frequently try different and new foods.	5-Point Likert Scale	Siegrist et al. (2013)

FN2	I do not trust new food products.	Ich vertraue neuen Lebensmitteln nicht.	I don't trust new food products.	5-Point Likert Scale	Food neophobia scale: Pliner & Hobden (1992)
FN3	I am afraid to eat foods I have never had before.	Ich bin besorgt neue Lebensmittel zu essen, die ich noch nie zuvor gegessen habe.	I'm afraid to eat new foods I have never eaten before.	5-Point Likert Scale	
Health Motivation					
HM1	It is important to me that the food I eat on a typical day is nutritious and keeps me healthy.	Es ist wichtig für mich, dass das Essen was ich an einem typischen Tag esse nahrhaft ist und mich gesund hält.	It is important to me that the food I eat on a typical day is nutritious and keeps me healthy.	5-Point Likert Scale	Steptoe, Pollard, & Wardle (1995)
HM2	I eat what I eat because it is healthy.	Ich esse was ich esse, weil es gesund ist.	I eat what I eat because it is healthy.	5-Point Likert Scale	Renner et al. (2012); Siegrist et al. (2015)

Table A1: Operationalization of survey items, translation and back-translation.

9.3 Analysis Output

Model Summary for Dependent Variable AI

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,721[a]	,520	,508	,72897	2,029

a. Predictors: (Constant), IB2, TR1, RAT, UB, RB, VB, CP, RAH

Model Summary for Dependent Variable AB

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,693[a]	,481	,467	,78610	1,904

a. Predictors: (Constant), IB2, TR1, RAT, UB, RB, VB, CP, RAH

Table A2: Results of R^2 analysis.

Coefficients – Dependent Variable: AI

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,684	,506		3,327	,001
	RAH	,274	,075	,210	3,657	,000
	RAT	-,158	,065	-,096	-2,409	,017
	CP	,381	,061	,356	6,260	,000
	TR1	,191	,040	,198	4,816	,000
	UB	,003	,047	,003	,059	,953
	VB	-,167	,061	-,131	-2,733	,007
	RB	,010	,044	,010	,235	,815
	IB2	-,115	,050	-,114	-2,302	,022

Coefficients – Dependent Variable: AB

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,358	,546		2,487	,013
	RAH	,381	,081	,281	4,716	,000
	RAT	-,284	,071	-,168	-4,023	,000
	CP	,342	,066	,308	5,206	,000
	TR1	,182	,043	,182	4,240	,000
	UB	-,088	,051	-,077	-1,747	,082
	VB	-,006	,066	-,004	-,084	,933
	RB	,041	,048	,039	,859	,391
	IB2	-,114	,054	-,109	-2,118	,035

Table A3: Results from linear reggression analysis

Rank RAH		Adoption Intention Yes	Adoption Intention No	Total
Rank given	missing	20	12	32
	1	104	66	170
	2	45	44	89
	3	10	8	18
	4	4	3	7
Total		183	133	316

Rank RAT		Adoption Intention Yes	Adoption Intention No	Total
Rank given	missing	20	12	32
	1	28	33	61
	2	54	30	84
	3	63	38	101
	4	18	20	38
Total		183	133	316

Rank CP		Adoption Intention Yes	Adoption Intention No	Total
Rank given	missing	20	12	32
	1	11	11	22
	2	31	30	61
	3	40	39	79
	4	81	41	122
Total		183	133	316

Rank TR		Adoption Intention		
		Yes	No	Total
Rank given	missing	20	12	32
	1	20	11	31
	2	33	17	50
	3	50	36	86
	4	60	57	117
Total		183	133	316

Rank UB		Adoption Intention		
		Yes	No	Total
Rank given	missing	6	2	8
	1	9	11	20
	2	32	17	49
	3	44	40	84
	4	92	63	155
Total		183	133	316

Rank VB		Adoption Intention		
		Yes	No	Total
Rank given	missing	6	2	8
	1	87	75	162
	2	40	34	74
	3	33	18	51
	4	17	4	21
Total		183	133	316

Rank RB		Adoption Intention		
		Yes	No	Total
Rank given	missing	6	2	8
	1	68	32	100
	2	44	38	82
	3	43	32	75
	4	22	29	51
Total		183	133	316
Mean		2,11	2,44	

Rank IB		Adoption Intention		
		Yes	No	Total
Rank given	missing	6	2	8
	1	13	13	26
	2	61	42	103
	3	57	41	98
	4	46	35	81
Total		183	133	316
Mean		2,77	2,75	

Table A4: Results of the case experiment - ranking factors