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# The role of consumers in food innovation processes

Role of  
consumers in  
food innovation  
processes

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## Abstract

**Purpose** – The need for consumer involvement in innovation processes has been recognised for four decades. Consumer involvement as a part of open innovation is an important strategy in the food sector, specifically for enhancing consumer acceptance and promoting successful market introduction. The purpose of this paper is to systematically analyse the concept of consumers' role and the level of consumer integration and interaction in recent food innovation processes.

**Design/methodology/approach** – In 2016, a three-step literature search was performed to identify the state-of-the-art scientific literature on consumer-involvement approaches and methods in the food sector. These methods and approaches were qualitatively analysed based on categories in accordance with the qualitative content analysis method.

**Findings** – A key finding is that most implemented consumer-involvement approaches and methods fall under von Hippel's manufacturer-active paradigm rather than the customer-active paradigm (CAP). However, there are practical reasons for the low diffusion of CAP. The presumed reasons include needed change of the perception of roles and of organisational structures, as well as a lack of trust among actors.

**Practical implications** – There remains a need to promote an active role for consumers, especially amid changing consumer demand and increasingly conscious consumer behaviour concerning food production and processing conditions.

**Originality/value** – This paper contributes to the theoretical and practical discussion about innovation management by reflecting on the innovation paradigm underlying an approach or method. The paper may also have practical implications for the choice and implementation of business models that consider consumers' role.

**Keywords** Crowdsourcing, Open innovation, Consumer acceptance, Co-design of innovation, Consumer-involvement methods, Consumer-led NPD

**Paper type** Literature review

## 1. Introduction

The need for consumer involvement in innovation processes has been recognised for decades, first by von Hippel (1978). During a shift from linear (science-driven) to more systemic and market-pull innovation models, the concept of consumer-led product development was introduced in the early 1990s by Urban and Hauser (1993). Consumer involvement is a market-oriented strategy for enhancing consumer acceptance and promoting successful market introduction and diffusion of innovation (Urban and Hauser, 1993). The utility of this strategy for safeguarding a company's competing power has also been confirmed in the food sector (Costa and Jongen, 2006; Grunert and Valli, 2001; MacFie, 2007; Stewart-Knox and Mitchell, 2003).

The primary innovation strategy for involving consumers is open innovation (OI). OI is not a concept with clear boundaries (Huizingh, 2011) but rather takes a variety of forms (Sarkar and Costa, 2008). Chesbrough *et al.* (2006, p. 1) define OI as "[...] the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation". OI processes involve not only external knowledge at initial stages, but also continuous participation by internal and external stakeholders at all stages. OI strategy seeks to establish organisational networks and benefit from cooperation with customers, suppliers, research institutes and teaching institutions to enhance an organisation's innovation capacity (Chesbrough, 2003). Typically, OI strategy includes a multitude of different actors; thus, consumer integration is only one issue in the food sector



(Fortuin and Omta, 2009; Sarkar and Costa, 2008). Consumer involvement in the food sector can be classified as “inbound open innovation” because consumer knowledge is a type of external knowledge exploited by companies to develop innovations (internal use) (cf. Huizingh, 2011).

A broad range of concepts are dedicated to consumer involvement. In certain instances, different terms are used to describe the same phenomena. This variety leads to complexity and, sometimes, confusion. Table I provides an overview of the terms used and their definitions in the literature.

Within these various consumer-involvement concepts (Table I), a wide spectrum of approaches to and methods for involvement have been developed with different potential applications. Methods for early innovation stages in the food industry, especially for identifying opportunities, were described and analysed by van Kleef *et al.* (2005) and van Kleef and van Trijp (2007). Van Kleef *et al.* (2005) determined the methods’ strengths and weaknesses to provide guidance for the level of appropriateness in food product development. Nevertheless, Grunert *et al.* (2008, p. 599) identified, among other issues, a lack of mapping and analysis for the various “forms of user-driven innovations” and their “degree of consumer orientation” in the food sector. These research needs are consistent with the consumer-led product development deficiencies in the food sector identified by Costa and Jongen (2006). Currently, scientific articles in peer-reviewed journals do not describe consumers’ role in an approach, method or innovation paradigm. German innovation literature (discussion papers and academic anthologies) addresses consumers’ role in the methods and level of integration for empirical implications but does not discuss consumers’ role in the approaches on a theoretical level (cf. Kunz and Mangold, 2004).

Concept/term	Definition	References
User-oriented innovation	“[...] as a process towards the development of a new product or service in which an integrated analysis and understanding of the users’ wants, needs and preference [...]” (p. 591)	Grunert <i>et al.</i> (2008)
User-driven innovation	“[...] customers proceed to modify or adapt existing products according to their own needs” (von Hippel in Grunert <i>et al.</i> , 2008, p. 591)	von Hippel (1978), Grunert <i>et al.</i> (2008)
User-led innovation	“[...] customers proceed to modify or adapt existing products according to their own needs” (p. 99)	Estrada-Flores (2010)
Consumer-led product development	“[...] the development of new product ideas is based on input from consumers, and where the screening of ideas, their development into product concepts, the development and testing of prototypes, the development of the overall marketing mix and finally the launch on the market all are consumer-led” (p. 84)	Grunert and Valli (2001), Urban and Hauser (1993)
Consumer-led food product development	“[...] market-oriented innovation concept concerning the use of consumers’ current and future needs and its determinants in the development of new products with true added value” (p. 458)	Costa and Jongen (2006)
Consumer-led innovation	“[...] use of customer needs [...]” (p. 99)	Estrada-Flores (2010)
Consumer-oriented food product development	No specific definition	Benner <i>et al.</i> (2003)
Collaborative product innovation	“[...] a company culture focused on the consumer and by applying appropriate consumer input throughout the innovation process. This collaboration between the consumers and the companies is named collaborative product innovation (CPI) [...]” (p. 8)	Guiné <i>et al.</i> (2016)

**Table I.**  
Range of concepts and terms related to consumer involvement

With this review paper, the aforementioned research gaps have been addressed. The objective of this paper is to analyse the role of consumers and particularly the level of consumer integration and interaction in recent food innovation processes. Therefore, the state-of-the-art of scientific literature regarding consumer-involvement approaches and methods in the food sector was summarised and analysed. This paper contributes to the theoretical discussion about innovation management by reflecting the innovation paradigm underlying an approach or method. (The innovation paradigm forms the theoretical basis for the consumer's role under the particular approach or method.) The paper may also have practical implications for the reflective choice and implementation of business models that consider consumers' role.

The structure of the paper is as follows: first, the research methodology and materials used for this review are described. Second, the options for consumer involvement and links between the approaches and methods discussed are introduced. Third, the consumer's role in each approach or method and at the different innovation stages is analysed. Fourth, the innovation paradigm underlying each approach and method and the paradigm that dominates the food sector are discussed. Finally, analysis-based challenges are identified and conclusions for the food sector are drawn.

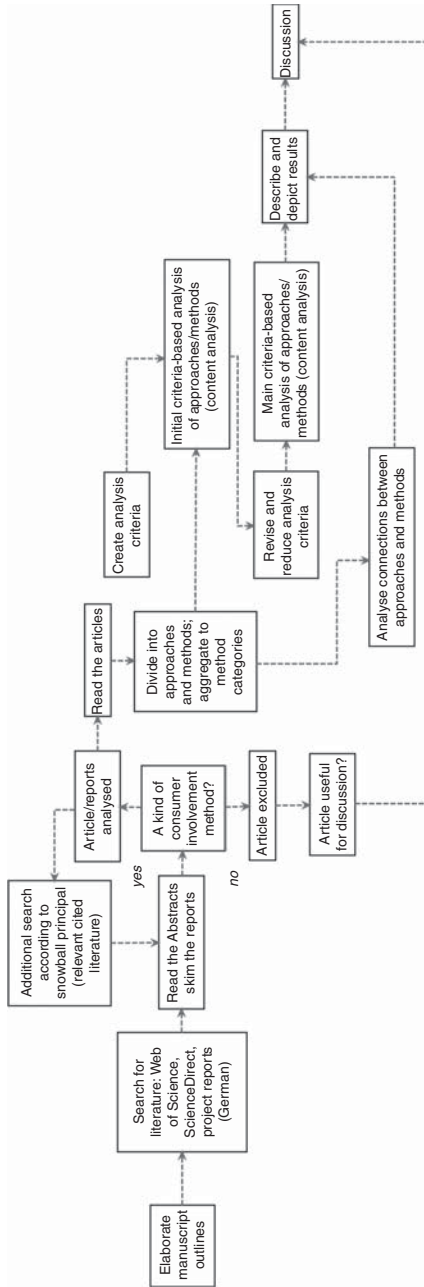
## 2. Material and methods

The scientific literature (cf. Fink, 1998, 2005; Petticrew and Roberts, 2006) regarding consumer involvement in the approaches to and methods for innovation was systematically reviewed. According to Petticrew and Roberts (2006, p. 39), a systematic literature review "[...] aims to comprehensively identify all relevant studies to answer a particular question, and assesses the validity (or 'soundness') of each study taking this into account when reaching conclusions". Fink (1998, p. 3) describes a literature review as "systematic" and "explicit" using a "reproducible method". To follow these core principles, we planned and documented in detail the methodological procedures used for this review. Figure 1 illustrates each step of this procedure. The individual steps are described in Sections 2.1-2.3.

### 2.1 Literature search, selection and description of data set

In April 2016, a three-step online literature search was performed to identify publications on consumer involvement in food innovation processes. The aim of the literature search was to identify all relevant consumer-involvement approaches and methods and their diffusion documented in the scientific literature. First, the major electronic databases Web of Science (formerly ISI) and ScienceDirect were used to search for scientific publications from 2000 to 2016. On each database, the search included the following key terms: consumer involvement (OR consumer-led/ consumer-oriented/ consumer-based/ consumer integration) AND food sector (OR food industry) AND innovation(s) (OR innovation processes/ innovation development/ product development/ generation of innovation). Second, additional publications were searched by examining the reference lists of the previously identified publications and using the relevant identified approaches/methods as key terms in the databases. Finally, the data set was supplemented through a general internet search for German research project reports that apply consumer-involvement approaches/methods. All the steps in selecting the relevant publications were based on screening titles, keywords and abstracts. A large corpus of literature was used that does not describe an approach or method and practical web-based examples for the papers' discussion sections.

The data set consists of 73 publications that describe an approach or method. Most (58) are peer-reviewed articles published in scientific journals, including reviews, research and conceptual articles and viewpoint papers. Additional types of publications include book



**Figure 1.** Flowchart of the methodological procedure

chapters, discussion papers, project reports and doctoral theses. Table AI provides an overview of the relevant literature identified from this review of consumer-involvement approaches/methods.

## 2.2 Framework for analysing the approaches and methods

The methods and approaches were qualitatively analysed based on categories in accordance with the qualitative content analysis method (Mayring, 2000). In this method, the aspects of the analysis are developed out of the material, and the categories are constructed in an inductive and iterative procedure oriented to a systematic reproduction process (Mayring, 2000).

The analysis results are described and illustrated using a matrix and graphics. First, the analysis categories were determined to provide an overview of the potential for the analysis. After an initial analysis, the categories were revised based on the information provided in the articles and reports. Reduction of the number of categories was necessary. The developed categories using an iterative process are strongly connected to the specific research questions.

The final version includes the following categories:

(1) Innovation stage(s):

*RQ1.* In which stage(s) of the innovation process was the approach/method applied?

*RQ2.* For which additional stage(s) is the approach or method possible or conceivable?

(2) Role of the consumer (according to Kunz and Mangold, 2004):

*RQ3.* How can the consumer's role in the innovation process be described?

(3) Degree of interaction (according to Kunz and Mangold, 2004):

*RQ4.* What level of interaction does the approach or method use?

(4) Innovation paradigm or philosophy:

*RQ5.* What is the underlying innovation paradigm or philosophy for each approach and method (related to the consumer's role)?

(5) Degree of diffusion:

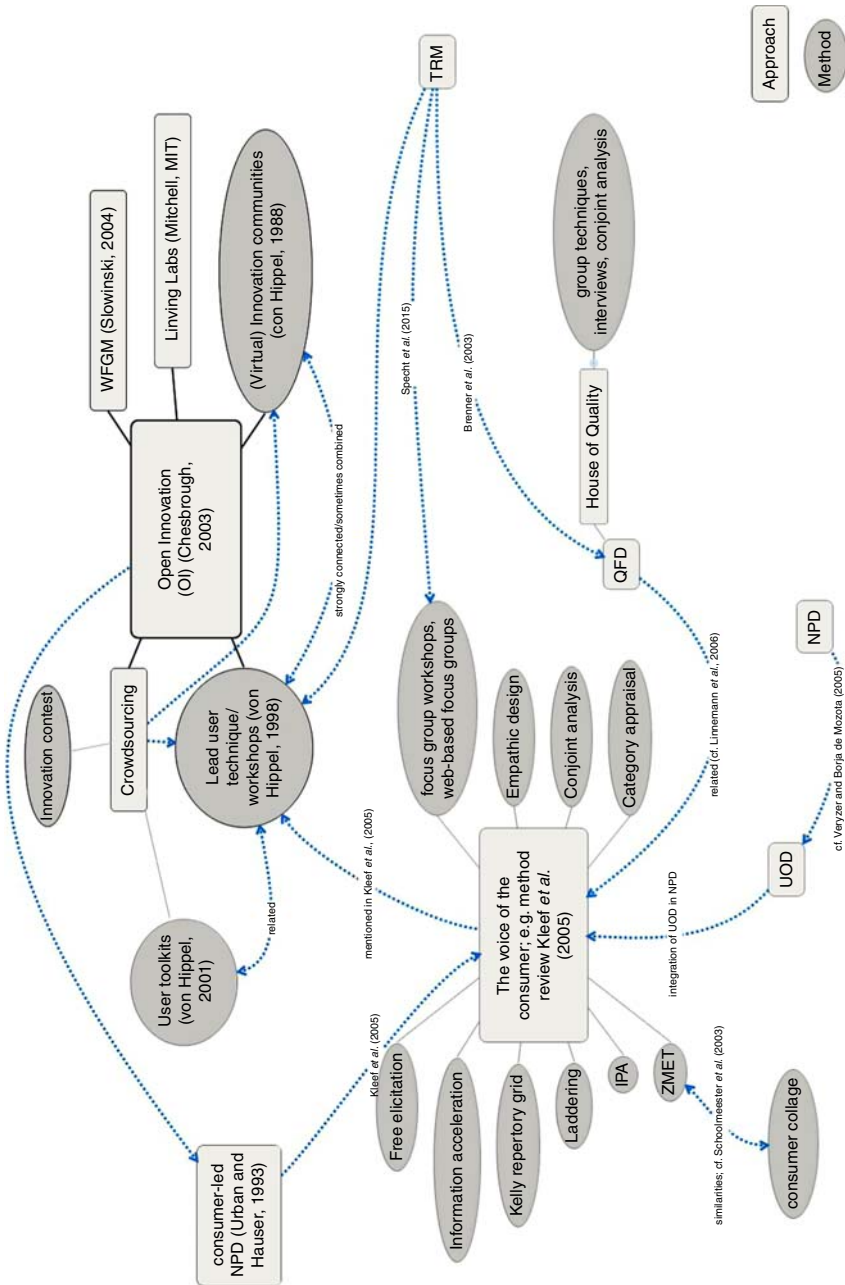
*RQ6.* Is the approach or method broadly diffused and adopted in practice in the food sector?

## 3. Results and discussion

### 3.1 Systemising and describing consumer involvement in the approaches to and methods for innovation

After screening the relevant articles and reports, a next step distinguished among the approaches and methods to analyse the above categories and understand the operational level for which these consumer-involvement opportunities were designed. A method can be defined as a concrete proposal for how to involve consumers by providing a step-by-step description of the procedure. An approach is defined as a general guideline that is more complex than a single method. Next, similar concepts were aggregated into one approach or method category. Figure 2 proposes a means for systemising the different approaches and methods and describes how they are linked.

A short description of the primary approaches and associated methods as illustrated in Figure 2 is provided in the following section.



**Figure 2.** Systemising the approach and method categories

The most important approach (which can also be characterised as a paradigm) is the OI approach and is defined in the introduction. The OI approach is the pillar paradigm to which most of the other approaches relate including the “want-find-get-manage” model (WFGM) (Slowinski, 2004), living labs (LL), crowdsourcing and consumer-led new product development (NPD) and to which certain methods relate, such as the lead user technique (von Hippel, 1988) (virtual) innovation communities and user toolkits (von Hippel, 2001; von Hippel and Katz, 2002).

The WFGM was developed by Slowinski (2004) and offers an approach for describing OI practices (Garcia Martinez, 2013). The innovation process is divided into four phases (want, find, get, manage) that determine how and when internal and external knowledge should be involved (Bigliardi and Galati, 2013). Generally, the WFGM model considers consumer needs and demands. However, the model itself does not imply specific methods for consumer involvement, and the literature does not provide suitable methods within the WFGM model.

*LL.* LL for innovations describes a proactive and user-centric OI approach for integrating the entire innovation process in real-life and application contexts (von Geibler *et al.*, 2013; Wolfert *et al.*, 2010). It is a strategic and systematic approach that builds on mutual learning from real-life experiments. The consumer is the co-designer of innovations by revealing needs, prototyping and validating innovative ideas and refining complex solutions such as in his household or in public consumption situations (von Geibler *et al.*, 2013).

Crowdsourcing is seen as one way to implement OI in a business model (Djelassi and Decoopman, 2013). Over the last several years, it has become a common business term. With crowdsourcing, a company or institution utilises large (online) networks of individuals to tap external knowledge, technologies and competency by opening up its innovation process (Oliveira *et al.*, 2010). The term does not denote a clearly outlined approach with consistent guidelines on how to integrate the consumer into the process. Rather, crowdsourcing is an umbrella term for various practices and activities that are mainly web-based and often use social media. Companies’ use of crowdsourcing is diffuse and wide-ranging. Methods such as the lead user technique, virtual innovation communities and innovation toolkits can be directly allocated to OI but are at the same time crowdsourcing practices. Crowdsourcing also includes methods that do not refer to active consumer involvement in the sense of collaborative design or co-design of innovation. For instance, crowdvoting is used to capture consumer preferences by providing fixed options for voting or crowdfunding to promote the financing of innovations by the “crowd”. Generally, the relationship between the crowdsourcer and the consumer or the “crowd” is close and win-win-oriented (Djelassi and Decoopman, 2013).

*Consumer-led NPD.* Consideration of user-oriented design and OI in NPD produced a proactive version of NPD: consumer-led NPD (Urban and Hauser, 1993; Veryzer and Borja de Mozota, 2005). Consumer-led NPD is a market-oriented innovation strategy that integrates consumers’ current and future needs in the early innovation process stages of opportunity/need identification and idea development (Costa and Jongen, 2006).

*Voice of the consumer (VoC): methods.* The main element of consumer-led NPD is the “VoC”. VoC is accompanied by numerous methods that reveal consumer needs and preferences. Most of the VoC methods are reviewed in van Kleef *et al.* (2005) and Grunert *et al.* (2010). The authors distinguish between methods that identify (latent) consumer needs without reference to a product (need-driven methods) and methods in which the consumer validates a concrete product idea (product-driven methods). At the same time, the need identification in these types of methods can be self-articulated by consumers or indirectly derived. Quantitative (structured) and product-driven techniques with indirect derivation of consumer needs are conjoint analysis (Grunert *et al.*, 2010) and importance-performance analysis (Grunert *et al.*, 2010). Free elicitation, the laddering method and the Kelly repertory



grid are personal interview techniques, in which the consumer's needs are self-articulated (van Kleef *et al.*, 2005). The latter three methods are unstructured (qualitative) and product driven. Other unstructured but need-driven techniques are focus groups, empathic design, the lead user technique and the elicitation technique (ZMET)/consumer collage. Additional structured and product-driven methods are category appraisal and information acceleration (van Kleef *et al.*, 2005).

Quality function deployment (QFD) does not primarily refer to the OI paradigm. It is a structured approach for enhancing communication between innovation actors and integrating VoC data into the product development process (Costa *et al.*, 2001). The set of planning tools incorporated supports more rapid product introduction or service improvement through managing the innovation process and safeguarding consumer satisfaction. Generally, the approach is more suitable for product improvements than for process improvements (Costa *et al.*, 2001). With the house of quality, the first QFD matrix, consumer needs and preferences can be translated into specific product requirements (Benner *et al.*, 2003; Costa *et al.*, 2001; Linnemann *et al.*, 2006). The house of quality is a structured planning matrix that resembles a house and consists of various "rooms" covering consumer preferences ("whats"), product requirements ("hows"), a relationship matrix with the relations between the "whats" and "hows", and a correlation matrix, which quantifies the correlations among different product requirements (cf. Linnemann *et al.*, 2006). To determine consumer preferences and needs for the "whats" of the house of quality, common methods include conjoint analysis, videotaping, group techniques, interviews, the fuzzy logic method and (online) surveys (Chan and Wu, 2002). These methods are not only used in the food sector.

Technological roadmapping (TRM) is a useful approach to strategic planning for innovations. It coordinates the development process and the market introduction of innovations during the entire innovation process (Phaal *et al.*, 2007). The outcome of the structured and phase-divided process is a time-based and multi-layered chart (the roadmap). The roadmapping process might involve a broad range of actors, including consumers, at the different stages of the innovation process. One method to involve consumers used in TRM is focus groups (Specht *et al.*, 2015). Although TRM has not been referred to as a consumer-involvement approach in the food sector in peer-reviewed journals, it is used, albeit sparingly, in this sector (e.g. see Section 3.2).

### 3.2 Analysis based on potential applications, consumer role and level of interaction

The potential applications for each approach and method during the innovation process are illustrated in Figure 3, which considers the different innovation stages. To draw conclusions on the level of integration and interaction, the consumer role was analysed based on the typology of Kunz and Mangold (2004) (Figure 3). According to this typology, the "level of integration and interaction" describes the intensity (depth) of consumers' integration in innovation processes and the intensity (depth and duration) of their interactions with the manufacturer and other consumers. The "level of integration and interaction" criterion is directly correlated with the "role of consumer" criterion (in Figure 3, illustrated as "consumer as [...]"). Thus, a more active consumer role, e.g., as described with the items "equal interaction partner with researcher/producer" (e) or "autonomous innovator" (g), corresponds to a high level of interaction (and vice versa).

The approaches WFGM, QFD and the house of quality and consumer-led NPD, as well as numerous methods (primarily closely linked to these approaches, including VoC), feature a low level of interaction. The consumer role in these approaches and methods is more passive ("passive object of observation" (a) and/or "heteronomous dialogue partner" (b)). A consumer cannot provide a solution. The consumer is only a respondent, whereas the manufacturer controls the innovation processes and is the responsible actor. Furthermore,



Figure 3 shows a short interaction time in most of these approaches and methods. In the literature consulted, empathic design, information acceleration, category appraisal, conjoint analysis and free elicitation were applied in the first stage, “opportunity and need identification”. The OFD approach also provides consumer involvement only in the initial innovation stage; consumer feedback in the latter innovation stage is not explicitly promoted (Benner *et al.*, 2003). In general, the consumer-led NPD approach is also suitable for the “design concept” or “adoption and diffusion” stage based on its original definition in Urban and Hauser (1993); however, the interaction is not continuous. Similar cases include ZMET/consumer collage and focus groups, which can be used at the beginning of the innovation process for the “idea generation” stage and later for the “prototyping and product testing” stage, especially for product perception and improvement in the case of ZMET/consumer collage. Focus groups are even conceivable for generating ideas in the “diffusion” stage. In both methods, the consumer’s ideas, statements or contributions are self-articulated (van Kleef *et al.*, 2005).

In innovation contests or virtual innovation contests used as a crowdsourcing practice, the consumer role is more extensive because consumers are “autonomous dialogue partners” (c). The manufacturer or crowdsourcer initiates the innovation process and screens the ideas. In the case of crowdsourcing, the crowdsourcer normally predetermines specific tasks that should be performed by the “crowd”. Generally, limited interaction occurs in the “idea generation”, “design concept” or “diffusion concept” stage. The level of integration and interaction is moderate.

In innovation communities, the consumer is an “equal interaction partner with other users or consumers” (d). (Virtual) innovation communities can be integrated in different stages for a short interaction time or continuously throughout the innovation process. In contrast to the above approaches and methods, here, the consumer initiates the innovation process. The manufacturer or crowdsourcer (in the case of virtual innovation communities) provides the platform and screens the ideas in certain cases. Innovation communities feature a higher level of integration and interaction.

In TRM, the consumer is an “equal interaction partner with other consumers” (d) or “[...] with the manufacturer” (e). The manufacturer initiates and accompanies the entire roadmapping process. Due to the nature of the process over several stages, the consumer interaction occurs over a long time period, and the level of interaction is high.

The consumers (who are often lead users) act as “equal partners with the manufacturer” (e) in the innovation workshops. The manufacturer plans and coordinates the innovation process. Typically, a workshop is a single event with a high level of interaction that can be applied at different stages or integrated in a roadmapping process.

The consumer role as an “autonomous innovator” (g) is provided in the innovation toolkit, LL approach and, sometimes, crowdsourcing. The consumer can often initiate the process on his own, while the researcher or manufacturer provides the setting. Due to the concepts underlying these approaches, the interaction can last for a long period of time and the level of interaction and integration is often high. In the approaches and methods listed in categories (c) through (g) (Figure 3), the consumer can provide a solution. Thus, the consumer’s role is an active one. These innovation processes are based on the idea of a collaborative design or co-design of innovation.

The analysis of peer-reviewed journal articles shows that in most approaches and methods, the consumer’s role is limited and that in these cases, the manufacturer manages and rules the innovation process. This finding is consistent with the manufacturer-active paradigm (MAP) by von Hippel (1978). The author describes the standard model used for industrial products, which is referred to as the MAP, and presents an alternative model for (more successful generation of) consumer-driven innovations, the customer-active paradigm (CAP). In the MAP, to generate consumer product ideas, the customer or consumer takes a

respondent role and only speaks “when spoken to” (von Hippel, 1978, p. 40). In contrast, the manufacturer holds an active role and controls the entire innovation process. He creates customer surveys, conducts need identification analyses and tests customer product perception (von Hippel, 1978). In the CAP model, the customer takes the initiative and contacts the manufacturer with his innovative idea. In the CAP, the manufacturer’s role is to screen customer ideas (“not needs”) (von Hippel, 1978).

The next paragraph analyses the diffusion of approaches/methods in the context of the MAP/CAP and the consumer’s role in the food sector.

### 3.3 Diffusion of approaches and methods related to the consumer’s role

To the knowledge of the authors, the MAP and CAP concepts are not mentioned in the food sector literature. Thus, to reflect MAP and CAP diffusion in the food sector, the recent diffusion of each approach and method in the sector has to be considered. The rating process includes the following aspects: quotations related to the approaches/methods in scientific journal articles, the number of cases studied using an approach/method and published in scientific journal articles and the approach/method applications for food companies applying additional limited web-based research. Table AI provides a systemised literature list in which the references are arranged according to each approach and method.

The approaches and methods in categories (a) (consumer as “passive object of observation”) and (b) (consumer as “heteronomous dialogue partner”) are common and have been widely adopted in the food sector (van Kleef *et al.*, 2005). The most cited methods in scientific peer-reviewed contributions are the conjoint analysis, the Kelly repertory grid and the laddering method (cf. Figure 3). The conjoint analysis has been applied, for instance, in consumers’ evaluation of product attributes in probiotic functional foods (Annunziata and Vecchio, 2013) and consumer preferences concerning seafood (Claret *et al.*, 2012). Among others, the Kelly repertory grid has been tested in two case studies on meat (Michel *et al.*, 2011; Russell and Cox, 2004). Grunert and Valli (2001) conducted a laddering study to derive attributes and consequences for beef and yoghurt. This laddering study is part of a pan-European study that describes consumer-driven NDP, also including the test of quality perception. There are also many examples of empathic design (e.g. Grunert *et al.*, 2010; Olsen, 2015; Williams *et al.*, 2015) and free elicitation (Drichoutis *et al.*, 2016; Justesen *et al.*, 2014) in peer-reviewed journals. An extensive list of examples is provided as supplementary material (Table AI). Consumer-driven NPD, which is the approach related to most methods in categories (a) and (b), is also often applied in the food sector and was introduced in the late 1990s (e.g. Costa and Jongen, 2006; Grunert and Valli, 2001; van Kleef *et al.*, 2005). Grunert *et al.* (2011), for instance, show how methods of disclosing consumer insights can support the development process of meat products in various innovation stages (identification of market opportunities, perception of quality, acceptance of technology, concept testing). To develop consumer-driven kiwi products, Jaeger *et al.* (2003) have used sensory profiles of consumer preferences.

The QFD concept enjoys a long tradition in the food industry (e.g. Benner *et al.*, 2003; Costa *et al.*, 2001; Linnemann *et al.*, 2006). A considerable number of articles with food case studies were discovered during the literature search, e.g., tests of fuzzy-OFD-based methods for beef barbecue (Park *et al.*, 2012) and for olive oil (Bevilacqua *et al.*, 2012). Additionally, Costa *et al.* (2001) published a review on the application of QFD in the sector, giving several examples, such as the sensory quality of ketchup or chocolate.

The methods with a moderate level of interaction and integration (categories (c) and (d)), innovation contests and innovation communities related to food products are seldom cited in peer-reviewed journal articles. Two German case studies on fast-moving consumer goods that used and tested innovation contests were published in a project report (Pobisch *et al.*, 2007) and a dissertation (Silvertant, 2011). In her dissertation, Silvertant (2011) analysed the

potential of innovation contests concerning idea generation and the identification of lead users. In the context of crowdsourcing, one example of a web-based innovation contest for new potato chip flavours is reported by Djelassi and Decoopman (2013). Nevertheless, the food sector frequently uses web-based, and sometimes incentive-based, innovation contests or intermediate platforms[1] connecting companies (crowdsourcers) with the innovative crowd or problem solver. Innovation communities in the food sector are considered in Blohm *et al.* (2013), Filieri (2013) and in Pobisch *et al.* (2007).

The lead user technique (level of interaction and integration (e)) is better known in other sectors and branches but is considered only in the method reviews by van Kleef *et al.* (2005) and van Kleef and van Trijp (2007). In addition to holding innovation contests, Pobisch *et al.* (2007) also conducted an innovation workshop with lead users to generate new ideas for bakery products.

As noted above, TRM is a widely applied approach in other industries but still does not play an important role in the food sector. As of today, two German case studies have been conducted in related areas. A regional network of food SMEs applies TRM to identify innovation opportunities and refine a future master plan to initiate innovation projects (foodRegio Roadmap “innovations” in Behrendt and Evers-Wölk, 2013). Consumers are considered an innovation impact factor but are not actors in the roadmapping process. An example of innovative food production and its marketing shows that this approach is generally considered a consumer-involvement approach (Specht *et al.*, 2015). In this case, TRM was implemented to explore the potential for rooftop farming products in Berlin by conducting focus group workshops. Focus groups are noted as an involvement method in the review by van Kleef *et al.* (2005) and van Kleef and van Trijp (2007).

Certain peer-reviewed food publications refer to innovation toolkits; however, all such publications describe the same Nestlé’s Food Service tool case and the customer-designed flavour experiments by BBA (a subsidiary of International Flavours and Fragrances) (Awazu *et al.*, 2009; Sarkar and Costa, 2008; von Hippel and Katz, 2002). In a broader sense, many consumer toolkits can be found on the internet such as McDonald’s “my Burger”[2], my Muesli[3] or design a tea[4]. Using these web-based tools, the consumer can create a personalised or customised food product by choosing and mixing the given food components or ingredients and, occasionally, by providing his own ideas and designs[5]. This production strategy is referred to as “mass customization”, which provides customised or modularized products or services on a mass basis (Davis, 1989; Fogliatto *et al.*, 2012). “Mass customization” was an innovation at its introduction. However, customised products in the food sector are often not real innovations because the customer creates a personal product that hardly ever leads to a market-introduced mass product. Manufacturers have rewarded good ideas and developed them into products in only a few cases. Consumers are not involved throughout the entire innovation process but are engaged only to provide ideas or needs.

The above examples of innovation toolkits can be considered crowdsourcing. A few more examples of crowdsourcing in the food industry are reported by Djelassi and Decoopman (2013). Companies enlist consumers to generate ideas for new flavours, recipes or packaging for dairy products (Djelassi and Decoopman, 2013). A case study from Italy reveals interesting insights of “consumer involvement at the ‘fuzzy front end’ of NDP process” (Filieri, 2013, p. 48). In the case of this internationally operating food firm, consumers contribute numerous product and service ideas of high quality and originality using a co-creation platform (Filieri, 2013). In addition to the examples in scientific literature and the above toolkits, there are numerous examples of crowdsourcing for food innovations on the internet[6].

For the latter approach in Figure 3, LLs are not common in the food sector based on literature citations. Only two relevant case studies have been published in peer-reviewed journals/books, one related to dairy products and one to food service (von Geibler *et al.*, 2013).

### 3.4 Reflection on innovation paradigms in the food sector

The literature analysis reveals that most implemented consumer-involvement approaches and methods fall under von Hippel's MAP. As mentioned above, this analysis is mainly based on the quotation rate in scientific literature that is primarily published in peer-reviewed journals (cf. Section 2.2 description of the data set). However, it must be noted that this result does not necessarily reflect the innovation reality in the food industry. It can be assumed that the diffusion of CAP approaches and methods in practice is considerably greater than that reported in the scientific literature. Three main reasons for this assumption are suggested: first, often business strategies, including consumer-involvement practices, are still maintained as company secrets. Companies may tend to be reluctant to disclose and publish internal processes. Second, the scientific publication processes are normally lengthy. Relatively new consumer-involvement practices may not yet be published. Third, company insights with a very practical orientation may be published in other, less scientific journals. Therefore, from this review, it is not possible to unequivocally conclude whether MAP or CAP is the dominant innovation practice. To further clarify, results from studies that conducted cluster analyses are helpful by giving fragmentary evidence regarding the diffusion of consumer-oriented OI. The implementation of OI strategies strongly depends on the type of firm and on innovation-related firm philosophies. Above all, medium- and large-sized firms specialized in fruit, vegetable and meat products are more likely to adopt OI strategies and CAP. This characterisation is true for almost half of the investigated UK, Spanish and Italian firms, according to Garcia Martinez *et al.* (2014). These firms are medium-high investors in R&D and intensively collaborate with a broad range of actors using various sources for innovation (Garcia Martinez *et al.*, 2014).

The majority of Spanish snack firms (60 per cent) with experiences in social media use these tools to realise CAP. The remaining 40 per cent use social media due to market pressure and do not act out of conviction. In these firms, social nets mainly serve communication needs and are utilised at a lower rate for finding collaborative consumers. Generally, this type of firm invests less in R&D and cooperates less with other actors such as suppliers, retailers and competitors (Iglesias-Sánchez *et al.*, 2014).

The implementation of CAP appears promising for firms' market success (Iglesias-Sánchez *et al.*, 2014; Garcia Martinez *et al.*, 2014) because it prioritises their innovation strategy and reduces market uncertainty (Filieri, 2013). Nevertheless, there are several practical reasons for the low diffusion of CAP. From an open and collaborative innovation perspective in the food sector, the following reasons were observed:

- (1) Perception and understanding of manufacturer and consumer roles: manufacturers' and researchers' perceptions of the consumer and manufacturer roles are often unconscious. Thus, many manufacturers follow conventional and common procedures without critically reflecting on these roles (cf. von Hippel, 1978). Houman Andersen and Balslev Munksgaard (2009, p. 202) confirmed that product development process management is strongly influenced by established roles and positions that are often static; this finding applies to not only individual firms but also the sector's structure and chain (Bigliardi and Galati, 2013; Houman Andersen and Balslev Munksgaard, 2009). Many manufacturers in the food sector tend to be reluctant to pay more attention to proactive strategies for consumer involvement (Costa and Jongen, 2006). The implementation of CAP requires a conscious shift in firm philosophy to a collaborative mindset (Iglesias-Sánchez *et al.*, 2014; Garcia Martinez *et al.*, 2014). However, a significant number of firms in the sector should pursue changes in innovation thinking and has "a need of a new skill for food firms in adopting OI" (Bigliardi and Galati, 2013, p. 22).
- (2) Organisational challenges: the MAP is often perceived as the established and well-known procedure for manufacturers (von Hippel, 1978). Shifting to OI strategies

or the CAP requires a change in organisational structure within the company (Bigliardi and Galati, 2013; von Hippel, 1978; Garcia Martinez *et al.*, 2014) and between innovation partners (Costa and Jongen, 2006; Garcia Martinez *et al.*, 2014). Costa and Jongen (2006) reported that everyday company routines lack guidelines for implementing consumer-led NDP.

- (3) Knowledge base: Houman Andersen and Balslev Munksgaard (2009) stated that food innovators' knowledge is often technology related. In contrast, the customer's experience and knowledge are primarily consumption and need related. Therefore, customer information is often not directly convertible into a product (Jeppesen, 2005 cited in Houman Andersen and Balslev Munksgaard, 2009, p. 201f). However, the cluster analysis by Garcia Martinez *et al.* (2014) reduces this argument by revealing that European food firms with implemented OI strategies are often technology oriented.
- (4) Lead user accessibility: lead users who overtly express their needs are difficult to find in the food sector; there is a large gap between expert users (e.g. sophisticated cooks) and normal or mass consumers. Sophisticated food users develop their own food products or other innovative ideas rather than collaborate with mass manufacturing suppliers. "Consumers of processed food products (i.e. ready-made meals and salads) are at the same time those consumers who are less involved in development. As a consequence of this, suppliers of non-durable food products look elsewhere [supplier and retailer] in their business network for innovative inputs to product development" (Houman Andersen and Balslev Munksgaard, 2009, p. 201).
- (5) Trust: applying the CAP or OI strategy is grounded in trust among the innovation partners (cf. Bigliardi and Galati, 2013); a lack of trust in sharing insider knowledge and sensitive data such as trade secrets (Fortuin and Omta, 2009) with other actors may hamper the feasibility of implementing strategies in the food sector. According to Garcia Martinez *et al.* (2014), firms that already apply OI strategies intensively use IP protection mechanisms because these approaches are considered important for innovative collaborations.
- (6) Effectiveness: a risk benefit analysis may aid in rating the effectiveness of the CAP or OI. Keupp and Gassmann (2009 cited in Huizingh, 2011) commented that the feasibility of OI might be negatively affected by the high transaction costs associated with using external knowledge. Thus, further research on the costs of OI processes is necessary (Huizingh, 2011).

#### 4. Final remarks

The objective of this review was to analyse the role of consumers, such as the level of consumer integration and interaction in recent food innovation processes reported in scientific literature. Furthermore, the innovation paradigm underlying consumer-involvement approaches to and methods for innovation was discussed. This reflection contributes to the theoretical debate about innovation management and may also have practical implications for the choice and implementation of business models and methods. The main result of the scientific literature analysis is that the MAP seems to continuously dominate the food sector, while the consumer's role still seems rather passive. However, the diffusion of CAP approaches and methods in practice is assumed to be considerably greater than is reported in the scientific literature. From a scientific perspective, determining whether CAP is gaining more prominence in the food sector will require more empirical data in this regard and ongoing documentation of current practices in the scientific literature. In the food sector, the importance of consumer integration is well known. However, from a practical perspective, there remain practical reasons of low diffusion of CAP.

The presumed reasons include needed changes in role perception and organisational structures and a lack of trust among actors. As a next step, it would be useful to continue discussing these challenges between scientists and practitioners.

The publication and dissemination of best practice examples could further promote an active role for consumers and the collaborative design of innovations. This promotion of CAP is needed, especially amid changing consumer demands and increasingly conscious consumer behaviour concerning environmental issues, animal welfare and health, and traceability in food production and processing. This debate indicates growing consumer awareness and sensibility associated with these issues and that consumers want to be adequately integrated into food sector innovation processes.

### Notes

1. [www.innocentive.com](http://www.innocentive.com); <https://de.eyeka.com>; [www.jovoto.com](http://www.jovoto.com); [www.ninesigma.com](http://www.ninesigma.com); [www.ideaken.com](http://www.ideaken.com)
2. <https://myburger.mcdonalds.co.uk/>
3. [www.mymuesli.com](http://www.mymuesli.com)
4. [www.designatea.com/](http://www.designatea.com/)
5. E.g. Nestlé Idea Atelier ([www.nestle-marktplatz.de/view/Mitmachen/Produktidee](http://www.nestle-marktplatz.de/view/Mitmachen/Produktidee))
6. [www.kraftrecipes.com/about/collaborate-with-kraft.aspx](http://www.kraftrecipes.com/about/collaborate-with-kraft.aspx); [www.theheinekencompany.com/about-us/innovation/innovators-brewhouse](http://www.theheinekencompany.com/about-us/innovation/innovators-brewhouse); <http://mystarbucksidea.force.com/>

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Appendix

Key references	Type of publication	Short description of content
<i>Want-find-get-manage model (WFGM)/consumer value creation</i>		
Bigliardi and Galati (2013)	Journal article (review paper)	Review of 3 OI approaches in the food sector, only one approach – the WFGM – considers consumers
Garcia Martinez (2013)	Book chapter in scientific anthology (conceptual article)	Introduction of the OI strategy applied by Mars, Incorp., application of WFGM
<i>Living lab approach (LL)</i>		
Wolfert <i>et al.</i> (2010)	Journal article (research paper)	Presentation of a research methodology in the agri-food sector, examples from the Dutch arable farming
Henningsson <i>et al.</i> (2011)	Book chapter in scientific anthology (research article)	Presentation of a food LL related to the export of dairy products (Arla foods), development of a software prototype
von Geibler <i>et al.</i> (2013)	Web-published project report (German study)	Potentials of LL with focus on sustainability innovations, LLs in different sectors (including food service industry: Danone LL Haar, Restaurant of the Future Wageningen)
<i>Crowdsourcing</i>		
Djelassi and Decoopman (2013)	Journal article (research paper)	Introduction into crowdsourcing, analysis of 5 case studies of consumer goods companies, e.g. Danone, Michel & Augustin and Lay's
<i>Quality function deployment (QFD), house of quality and quality change modelling (QCM)</i>		
Linnemann <i>et al.</i> (2006)	Journal article (viewpoint paper)	Discussion on consumer-driven food product development, overview and explanations on QFD, house of quality, and QCM
Benner <i>et al.</i> (2003)	Journal article (review paper)	Introduction into the OFD approach, application of QFD in food industry, strengths and weaknesses of QFD
Costa <i>et al.</i> (2001)	Journal article (review paper)	Review on the applications of QFD in the food sector, case study: ketchup quality improvement; benefits and challenges of QFD applications
Park <i>et al.</i> (2012)	Journal article (review paper)	Test of the fuzzy-QFD based methodology to promote Korean beef barbecue (bulgogi) for international customers
Bevilacqua <i>et al.</i> (2012)	Journal article (research paper)	Test of the fuzzy-QFD based methodology for olive oil
<i>Consumer-led NPD</i>		
Costa and Jongen (2006)	Journal article (viewpoint paper)	Introduction into the concept and its main implementation stages, application limitations in European food industry
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods and techniques in the first stage of NPD, focused on understanding consumer needs methods in food industry
Grunert <i>et al.</i> (2011)	Journal article (research paper)	Use of consumer insight in the new product development process in the meat sector; concept of quality perception, consumer technology acceptance, concept testing, prototype testing
Grunert and Valli (2001)	Journal article (research paper)	Consumer-led product development for food product innovations, analysis how consumer perceive the quality of beef and yoghurt (pan-European study)

(continued)

**Table AI.**  
List of literature  
(corresponding  
literature references  
for each approach  
and method)

Key references	Type of publication	Short description of content
Jaeger <i>et al.</i> (2003)	Journal article (research paper)	Consumer-driven product development in the kiwifruit industry
Innovation toolkit approach/user toolkits		
von Hippel and Katz (2002)	Journal article (conceptual paper)	Introduction into toolkits and description of toolkits experiments in food products industry (Nestle Food Services)
Sarkar and Costa (2008)	Journal article (review paper)	Dynamics of OI in food sector, description of toolkits experiments in flavour industry (BBA, IFF)
Awazu <i>et al.</i> (2009)	Journal article (research paper)	description of toolkits experiments in flavour industry (BBA, IFF) and food products industry (Nestle Food Services)
Innovation contest		
Pobisch <i>et al.</i> (2007)	Web-published discussion paper (German study)	Introduction of divers forms of consumer integration in sustainability innovations, case study about innovation contests concerning bakery products
Silvertant (2011)	Doctoral dissertation (published as book in German, empirical study)	Description of innovation contests as method to generate innovation ideas, empirical analysis in the food and beverage industry
(virtual) Innovation communities		
Blohm <i>et al.</i> (2013)	Book chapter in scientific anthology (research article)	Development, management, and implementation of open innovation communities in food industry, case study about open innovation scorecard
Pobisch <i>et al.</i> (2007)	Web-published discussion paper (German study)	Introduction of divers forms of consumer integration in sustainability innovations, case study about innovation contests concerning bakery products
Filieri (2013)	Journal article (research paper)	A case study from Italy, "consumer involvement at the "fuzzy front end" of NDP process", consumer co-creation platform
Innovation workshop/lead user technique/workshops		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods and techniques in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Pobisch <i>et al.</i> (2007)	Web-published discussion paper (German study)	Introduction of divers forms of consumer integration in sustainability innovations, case study about lead user technique concerning bakery products
Focus group workshops/web-based focus groups		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
<i>Roadmapping (TRM)</i>		
Specht <i>et al.</i> (2015)	journal article (review paper)	application of a roadmapping process for urban food production and its marketing (rooftop greenhouse)
Behrendt and Evers-Wolk (2013)	report	regional food network, foodRegio
Category appraisal		

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(continued)

Key references	Type of publication	Short description of content
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Overview and explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Conjoint analysis		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Annunziata and Vecchio (2013)	Journal article (research paper)	Application of conjoint analysis on probiotic functional foods, case study on consumers evaluation of product attributes
Claret <i>et al.</i> (2012)	Journal article (research paper)	Application of conjoint analysis on seafood, case study on consumer preferences
Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
Empathic design		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
Free elicitation		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Information acceleration		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Kelly repertory grid		
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Martinez Michel <i>et al.</i> (2011)	Journal article (research paper)	Application of repertory grid method on meat, case study
Russell and Cox (2004)	Journal article (research paper)	Application of repertory grid method on meat, case study
Laddering		

(continued)

Table AI.



Key references	Type of publication	Short description of content
van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Grunert and Valli (2001)	Journal article (research paper)	Laddering study to derive attributes and consequences for beef and yoghurt
Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
Zaltman metaphor elicitation technique (ZMET) and van Kleef <i>et al.</i> (2005)	Journal article (review paper)	Detailed review of 10 consumer research methods in the first stage of NPD
van Kleef and van Trijp (2007)	Book chapter in scientific anthology (review article)	Review of 10 methods that are described in van Kleef <i>et al.</i> (2005), typology of consumer research, opportunity identification
Costa <i>et al.</i> (2003)		Exploring the use of consumer collages in product design; identification of emotions and experiences of consumers with meal preparation and Home Meal Replacements
Importance-performance analysis (IPA) Grunert <i>et al.</i> (2010)	Book chapter in scientific anthology (review article)	Explanations on consumer-oriented innovation in the food and personal care products sector, method review and context analysis
Back (2012)	Journal article (research paper)	Impact-range performance analysis and asymmetry analysis for improving quality of Korean food attributes
Approach/method		

Table A1.

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