PROJECT FINAL REPORT

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RECAPT

Retailer and Consumer Acceptance of Promising Novel Technologies and Collaborative Innovation Management

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1   Executive summary

Innovation is important for the future of the European food and drink sector. It can help to produce food and drink products that live up to the changing demands of consumers, and do so in a safe, environmentally/socially sustainable, and financially competitive way, given that innovation leads to new products and services that are accepted and valued by consumers.

The **purpose of the RECAPT project** was to support a process that leads to **closer collaboration in the management of innovations along the food supply chain**. The overall objective was to build the foundations of an EU platform that strengthens collaboration between food scientists, food industry and the retailing and catering sectors, so that research findings can be used effectively in the development of innovative and sustainable products that will be accepted by consumers and thereby contribute to the global competitiveness of the European food sector.

The most important part of RECAPT is the **Collaborative Food Innovation Forum (CFIF)**, which was set up to serve as a platform for effective dialogue and collaboration between food chain actors. In three CFIF workshops, food scientists, food manufacturers, retailers and caterers have discussed different aspects of collaborative innovation based on the findings of the research carried out by the project participants. Among the main findings of the project presented and discussed in the CFIF are:

- **Consumers and innovation**: the project has identified challenges facing the European food industry and a number emerging consumer wants and needs in relation food and drink. Most importantly, the project has identified three roads to consumer acceptance of products produced with novel technologies (the consumer benefit route, the retail/caterer service route and the technology attitudes route).

- **Innovation and promising novel technologies**: the project has identified and described 15 promising novel processing technologies that have the potential to lead to value-added food products and services and that have the potential for beneficial economic and social impacts on the food system and consumers.

- **Innovation, retailers and caterers**: the project has generated new insight into retailer and caterer decision-making when adopting new products, and in particular the role technologies play for such adoption decisions. A key result is that retailers are not particularly interested in technologies per se: what matters is the benefit to consumers.

- **Innovation management**: the project has conducted four new case studies of collaborative innovation management in the food sector. In all four cases studies, the use of novel technologies resulted in additional benefits to end consumers, and in two cases multiple parties benefitted from significant cost reductions due to the use of new processing or packaging technologies.

Based on the findings of the project, the CFIF has discussed the strategic implications for collaborative innovation management. These have been described in a number of position papers on, amongst other things, the role of technology in dealing with today's challenges for the food and drink industry, retailer and caterer assortment adoption decision processes, and collaborative innovation management in the food sector.

2   Project context and objectives

Innovation is a key issue for the future of the European food and drink sector, because it is necessary for ensuring that the European food and drink sector can live up to societal demands and can retain its international competitiveness. Innovation can help to produce food and drink products that live up to the changing demands of consumers, and do so in a safe, environmentally/socially sustainable and financially competitive way, provided that innovation leads to promising novel products and services that are accepted by consumers. New food and drink products are traditionally developed by the food industry, supported by input from food research. However, there is an increasing recognition that innovation is a task for all actors in the food chain, since innovation should add value to the food chain as a whole and lead to sustainable novel applications. In this context, the retailing and catering sectors play crucial roles. Retailers and caterers have daily contact with consumers and gather a wealth of information about prevailing trends in consumer demands and act as gatekeepers to consumers for novel products. They therefore perform an important bridging function, identifying consumer demands and linking them to food producers and food scientists who possess the know-how for the creation and management of innovative food products and services filling those needs.

Both producers and retailers have repeatedly expressed a wish for closer collaboration. Increased cooperation in the food chain, and especially between retailers, caterers, food producers and food scientists, could lead to a higher degree of innovativeness across the food supply chain, enabling food science and industry to convert research findings into products that reflect changing consumer demands, thus offering consumers a positive and trustful experience. In this way, two main outcomes are expected: a) production of products and management of processes in a way that will induce economic, social and environmental sustainability along the food supply chain; and b) as a direct outcome of this, increased generation of customer value diffused along the food supply chain. Through *collaborative management of innovations* it will be possible to manage entire food supply chains according to market orientation principles and to turn them into optimal "value chains", participation in which will be mutually beneficial for all chain members.

RECAPT has aimed at supporting a process that leads to such a closer collaborative management of innovations along the food supply chain. The **overall objective** has been to build the foundations of an EU platform that strengthens collaboration between food scientists, food companies, retailers and caterers, such that research findings can be effectively integrated into the development of innovative and sustainable products that meet consumer acceptance and thus contribute to global competitiveness of the European food sector. More specifically, RECAPT had the following strategic objectives:

1. To **promote information exchange** and facilitate trust building in order to enhance innovation-oriented cooperation among the actors along the food supply chain.

2. To **analyse all parameters** and **provide all necessary inputs** for the realization and viability of those collaborations

The overall structure of RECAPT is illustrated in Figure 1. The action consisted of seven sequential but interrelated WPs, distinguished based on the action's objectives into two main blocks: WP1 formed block I that is the core element of RECAPT and dealt with how to promote information exchange, facilitate trust building and enhance cooperation among actors in the food chain; whereas WPs 2-5 formed block II that analysed all parameters and provided all necessary inputs for the realization and viability of WP1. WP6 focused on

dissemination activities, while WP7 was devoted to project management. The aims and main results of each work package are outlined in Table 1.

Figure 1. WP structure
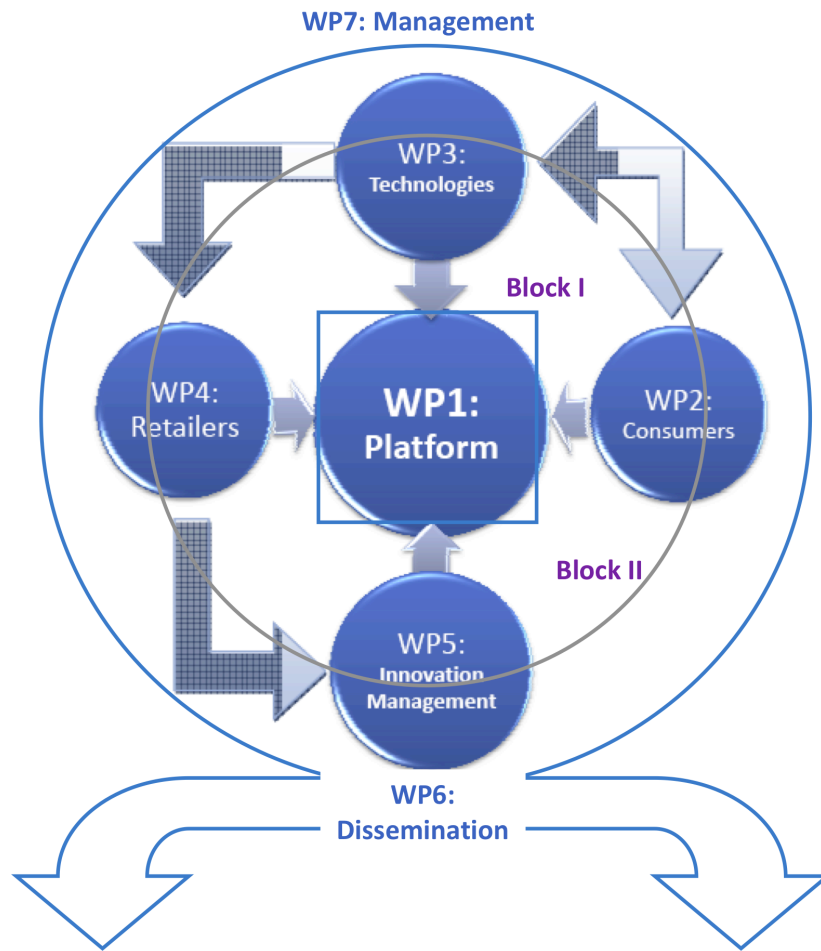
Table 1. Work Package objectives and main results

Work Package	Scientific and technological objective	Main results
WP1: Food Innovation Forum	To create a platform for effective dialog and collaboration between the food chain actors as a basis for delivering innovative, novel or improved products and services to support the competitiveness of the European food and drink industry and in line with European consumers' needs and expectations for healthy, quality, safe, affordable, convenient, environmentally-sensitive and ethical products.	The main results include improved collaboration in identifying new innovation opportunities, knowledge exchange and trust building between the main actors in the food chain (food scientists, food manufacturers, retailers and consumers), which has the potential to strengthen the European food innovation process and stimulate European competitiveness across the food chain.
WP2: Innovation and consumers	To analyse the factors that determine consumer acceptance of new products and processes in the food and drink sector, and the role that the retail and catering sectors play therein.	Identification of emerging consumer wants and needs and evaluation of consumers' acceptance and risk perceptions regarding new value-added concepts, products or services. Identification of strategic options for the Collaborative Food Innovation Forum.
WP3: Innovation and promising novel technologies	To identify promising novel processing technologies that can be used to produce innovative food products, but where consumer and retailer acceptance could be an issue.	Identification and description of 15 promising novel processing technologies that have the potential to lead to value-added food products and services and with the potential for having beneficial economic and social impacts on the food system and consumers
WP4: Innovation and retailers	To analyse how retailers and caterers make decisions to (1) adopt new food products (particularly products produced using novel technologies) in their assortment, and (2) become actively involved in new product development processes	Knowledge of current assortment decision-making processes, including mapping of the activities, roles and responsibilities of different actors in these processes. Identification of retailer and caterer concerns regarding novel technologies and the benefits of increasing information flows about technologies.
WP5: Innovation management	To identify best practice models for managing innovation in collaborative interactions between food manufacturers and retailers/caterers with a particular focus on open innovation and co-development	Best practice models and tools for food innovation management in collaboration between actors in the food chain. Portfolio model for developing balance portfolio of new food products.

3 Main results

The European food and drink industry is facing a number of important and inter-related challenges, which make innovation a joint challenge for retailers, caterers, food manufacturers and food researchers.

First and foremost, the European food and drink sector faces the challenge of identifying and satisfying fragmented and dynamic consumer demands. In addition to traditional product attributes such as high quality, convenience and value-for-money, consumers are increasingly demanding that the food products they buy and consume are healthy, authentic and sustainably produced.

Another challenge for food and drink manufacturers is the continuing concentration of the catering and retailing sectors. As retailers and caterers grow in size, they are trying to capture a larger share of the value created in the food chain, thereby putting manufacturers under growing pressure to lower prices. Along with the (re)emergence of alternative channels such as farmers' markets and farm shops, as well as the growth of internet retailing in food, this means that reaching consumers is becoming more challenging for manufacturers.

Furthermore, markets are becoming more global in terms of both demand and supply. Consumers are accustomed to having access to a broad and varied assortment of food products from across the world, irrespective of time of year and seasons. This is spurred further by the liberalization of world markets, which has increased competitive intensity along the entire food chain.

All in all, these challenges increase the need for the European food and drink industry to be innovative. Technologies exist or are emerging that can help the food industry meet these challenges in innovative ways. However, a final challenge for the European food and drink sector is that there are sometimes strong consumer concerns about new technologies being used in the production and processing of foods, as seen with the controversy surrounding genetic modification and functional foods in Europe.

Meeting the different challenges facing the food and drink industry using novel technologies in ways that meet consumer acceptance requires the involvement of actors across the entire value chain.

3.1 Innovation and consumers (WP2)

The overall objectives of WP2 were to analyse the factors that determine consumer acceptance of new technological processes and products in the food and drink sector, and the role that the retail and catering sectors play therein.

Emerging consumer wants and needs

A first step was to identify those emerging consumer wants and needs that may have relevance for acceptance of technology. Based on scientific literature and grey literature made available by producers and retailers that participated in this project, and completed on the basis of group discussions with members of CFIF, five emerging trends particularly relevant to food technology development and acceptance were identified:

- **Health**. Consumer´s increasing awareness of links between food and health has been one of the most important social developments in the recent years. A significant body of scientific literature documents that consumers nowadays are more interested in healthy food products to prevent diseases and maintain healthy living (Krutulyte,

2010). Consumers choose healthy products that satisfy their underlying values, such as living a long and healthy life. Health awareness continues to rise with the increasing availability of health information, going hand in hand with the ageing of populations and increased risk for lifestyle diseases (Kearney, 2010).

- **Convenience**. Convenience is one attribute of a food product for which demand is increasing (Buckley et al., 2005). There are different meanings of the word "convenience" referring to time utilisation, accessibility, portability, appropriateness, handiness and avoidance of unpleasantness. Convenience in the context of food can be defined in terms of reductions in time and effort (mental and physical) spent buying, storing, preparing and consuming food. Convenience foods are defined as any fully or partially prepared food in which significant preparation time, culinary skills or energy inputs have been transferred from the homemaker's kitchen to the food processor and distributor (Buckley et al., 2005).

- **Pleasure**. In spite of the ongoing economic downturn, hedonic food experience remains a major decision criterion amongst consumers. Consumers are expected to keep moving towards high quality enjoyable foods. This trend may possibly even be supported by the economic downturn, as food pleasures are considered to be small and affordable indulgences. This trend of allowing for selected food indulgencies has found its way into previously austere regimes such as health clubs.

- **Sustainability**. The recent increase in food prices emphasizes the necessity to move towards a sustainable production method. From fork to farm, actors at all levels of the food chain are increasingly called upon to take responsibility for their actions and the wider repercussions of these actions. In developed countries, food consumption is no longer linked to local production and local resources as consumers to the same extent have access to buying and consuming products from around the world. Consumers have grown accustomed to having access to a broad and varied assortment of foods irrespective of time of year and seasons. Typically consumers do not pay attention to the consequences of their consumption practices with regard to climate change, public health, social and economic inequality (nationally and globally), bio-diversity, animal welfare or the use of scarce resources (e.g., energy, soil and water). However, this is beginning to change.

- **Authenticity**. Authenticity refers to truthful, honest, sincere, un-mediated and un-alienated food. In the world of consumption, authenticity stands for everything that is natural, traditional or local. Authentic, local and pure ingredients are increasingly seen as quality marks (Skuras & Dimara, 2004; Innova, 2011). The quest for authenticity manifests itself in various trends, including the rise of organic agriculture and other extensive production systems, the slow food movement and its various regional duplications, the microbrewery craze at the beginning of the new millennium, various waves of comfort foods designed to bring back our childhood memories and new types of certifications such as protected designations of origin (PDOs) and protected geographical indications (PGIs). In product positioning, authenticity operates as a substitute for things that "actually" matter: health, ecological impact and responsibility for others.

On top of these the new consumer trends, established food choice motivations, such as good taste and a reasonable price, continue to be essential attributes in consumer choice (Bryla, 2012; Kuznesof et al., 2012; Share & Stewart-Knox, 2012). For this reason, we argue that the emerging trends, such as health, convenience, sustainability and authenticity, will add

consumer needs to the existing needs, tied up with product taste *and* price. With the emergence of new technologies, consumers are becoming very demanding. A more holistic trend can be identified that involves that all the previously mentioned trends are cumulative: the consumers 'want it all'. The specific trends do not replace one another, but they just add to the requirements that food manufacturers, retailers and caterers must satisfy.

What will this holistic trend (´Want it all´) mean for actors in the food chain? When developing business around products or services based on new technologies, actors in the food chain must realise that technologies aimed at serving emerging consumer needs should continue to address the classical needs such as price and taste. This issue is becoming clear for example in the case of convenience products, where consumers increasingly demand convenience and low price, but are not willing to accept reduced quality (Boer et al., 2002). For the actors in the food chain this issue means that addressing emerging consumer needs adds more challenges and opportunities beyond (rather than 'instead of') addressing long established consumer needs as taste and price.

A second important general trend is that technology is not only about delivering relevant end consumer benefits (in terms of products), but also about interactions in obtaining products and services (i.e. relationship attributes). One of the key advantages that Internet provides over the traditional distribution and communication channels is the ability to interact with consumers by accommodating their preferences and needs (Neelotpaul, 2010). The online channel helps food companies to establish long lasting relationships and design their products based on continuous interaction with the consumers. On-line consumers are active co-creators and trend-generators reducing significantly the control of the producer over the product. Collectively the consumer voice can bring great changes to how food products are produced or processed. Therefore, the relationship building and interactivity as a result of continuous two-way communication between consumers and producers is considered to be(come) an important consumer trend.

What will this holistic trend (´relationship building´) mean for actors in the food chain? The online media (in store or out-of-store) will change the balance of power consumer – producer/retailer. Consumers are the ones that initiate the interaction and can judge based on the other users 'experience if certain products are suitable to them. The image of a particular food technology and the overall technology success is very dependent on the consumers, as consumers can now instantly search for product information and performance in the existing information sources and provide immediate feedback.

Consumer acceptance of novel technologies

Innovative food technologies are continuously being developed. The success or failure of these innovations depends, to a large extent, on end-user acceptance of the technologies, as evidenced through consumer use of products created with those technologies. Although the importance of consumer acceptance of innovative products has long been acknowledged, the success rate of innovations in food remains low (e.g. Van Kleef, Van Trijp, & Luning, 2005). This implies that apparently, and in spite of major research efforts on technology acceptance, there is insufficient understanding how technology embedded in new products influences end-user purchase decisions.

When considering consumer purchase decisions of products created with novel technologies, three issues stand out as important paths through which technology attributes can influence end-user choice.

1) Tangible product attributes modified by a technology. Often, the purpose of new food technologies is to improve a particular product attribute (e.g. tenderising techniques improve texture) without altering other attributes (e.g. taste and safety). Such changes in product quality support the end-user in selecting the preferred product. Understanding consumer perceptions of product quality has been the subject of marketing and sensory research (see e.g. Andersen, 1994; Grunert, Hartvig Larsen, Madsen, & Baadsgaard, 1996; Poulsen, Juhl, Kristensen, Bech, & Engelund, 1996; Steenkamp & Van Trijp, 1996).

2) Specific attributes of a technology can create resistance against, or support for, the technology as a whole. These socio-political technology attitudes can influence the desirability of a product developed with those technologies. This approach has received considerable attention in risk psychology (following Slovic, 1987) and related applied research across several food technologies (Fife-Schaw & Rowe, 2000; Frewer et al., 2011).

3) Technologies can influence the way in which retail and catering companies offer products to the consumer, e.g. by allowing different presentation of product to the end-users leading to specific retail and service attributes. The role of retailers for innovation is relatively under-researched (Sorescu, Frambach, Singh, Rangaswamy, & Bridges, 2011).

The three paths by which technology can reach and influence the end-user are reflected in the consumer behaviour literature. Still, these roads are discussed in isolation and there is no systematic analysis of how technology attributes may influence end-user choice though a combination of these roads. The effects may interact at the product evaluation stage, or at the final choice moment. Knowledge of the effect of technology attributes through each route to final consumer choice allows the identification of a checklist of crucial technology attributes that may hinder or support consumer acceptance and choice for a product created with the new technology. To this aim, the current view on the effects of product quality attributes, technology attitudes and retail service attributes on consumer uptake of innovative technology was reviewed.

When we combine the available literature on acceptance of novel technologies in food, the three lines of literature discussed before appear indicative of three different ways in which consumer accept or reject a novel technology in food.

1) *A product attribute evaluation path*: this is the central route to consumer choice. Here technology allows the production of products with attributes that are valued by consumers, leading to inductive inferences (bottom up) of quality and choice. Most product marketing literature focuses on this path. An example would be tenderizing technologies that improve meat texture.

2) *A technology apprehension path*: this is a path where unfamiliarity and dread may lead to negative socio-political technology attitudes, which may in turn lead to categorical rejection. Alternatively, positive attitudes such as those towards naturalness may support product choice by reducing the consideration set of alternatives to only natural products. Besides limiting the choice of products, socio-political attitudes may also provide top-down, deductive inferences (top down) towards the product evaluation.

3) *A retail/caterer service path:* a service attribute route, where technology attributes may allow novel retail and caterer business models, product placement and customer

relation services. Such business models may result in inductive inferences (bottom up) about product attributes and thus the product as a whole, or may result in changes in store image that affect choice directly.

By combining these three paths into a single view on consumer product and service choice, we arrive at a single model that shows how technology and product development, as well as managerial decisions in the production chain, relate and contribute to consumer choice for products and services (see Figure 2). The model thus facilitates thinking about different ways to gain consumer acceptance of new technologies (as mirrored in the choice of products and services where these technologies have been used). The three paths identified by the model require managerial attention – although the routes may lead to consumer adoption, they also represent barriers to be overcome.

Figure 2: Theoretical basis for three paths to consumer acceptance.
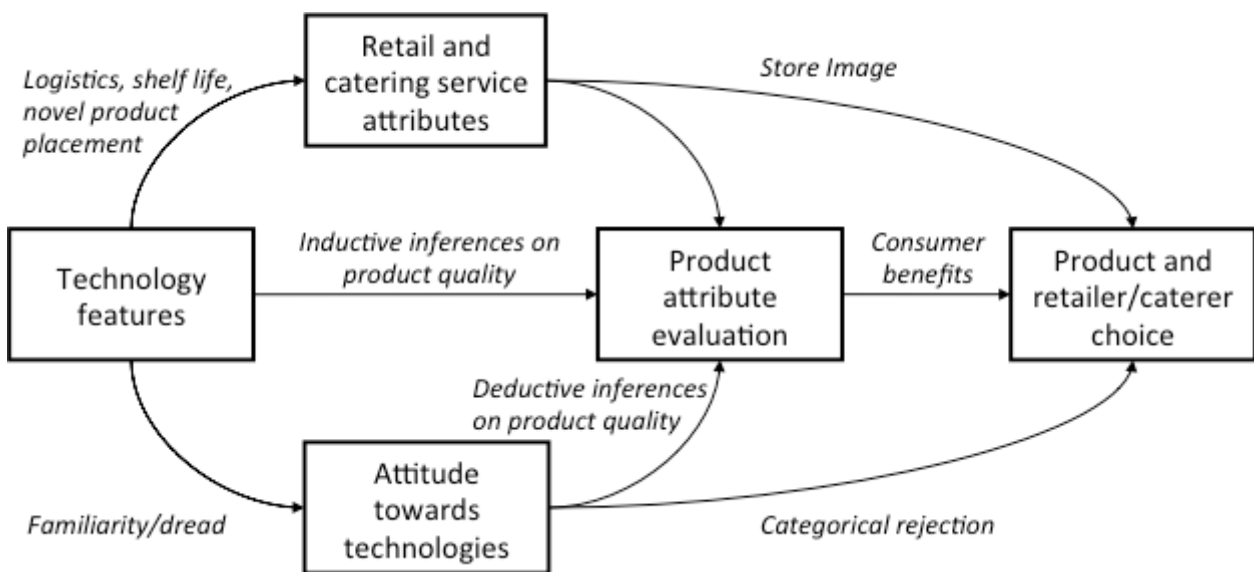
The model was then applied to four sets of technologies (mild processing technologies, electromagnetic methods, texturizing technologies, and novel packaging and storage technologies) for which the scientific literature on consumer acceptance was reviewed, and organized around the three paths. The amount of available evidence differs considerably between the technologies, confirming that they are at different stages in their life cycle; or that their acceptance by end-users received different levels of attention.

Overall, there is support in the literature for the proposed model, but it was concluded that the three routes toward consumer acceptance have largely gone un-integrated in the existing literature. Future scientific research should focus more on the integration and integration of the three paths of how technology features may affect end consumer acceptance. In terms of more practical implications a checklist was derived allowing a novel product to be checked against the general knowledge in the field related to each of the three paths. The checklist centers on the following three questions:

1. Does the technology change (experience or credence) product attributes?
2. Has the technology the potential to create strong socio-political technology attitudes:

a. Has the technology perceived dread elements? (e.g. many affected people, chance of mortality, long term effects?)

b. Is the technology perceived more technological than natural?

c. Is the technology otherwise socially or politically sensitive?

3. Does the technology change the way products are presented/delivered to the consumer in retail or catering?

Based on this, the four groups of technologies identified in WP3 as promising (electromagnetic methods, texturing methods, mild processing, and advanced packaging methods) were discussed in detail with the stakeholders present at the CFIF-meeting in Paris (October 2012). Together, this information has formed the basis for the formulation of strategic options for each of the technologies.

Although all four groups of technologies were perceived as promising, the consensus was that advanced packaging methods and mild processing technologies are expected to show the greatest potential in terms of consumer acceptance.

The overall conclusion was that for this potential to be realized in the market place, scientists and practitioners have to communicate any new technology and products based on that technology in a way that is easy to understand to ensure that consumers can make an informed choice.

3.2 Innovation and promising novel technologies (WP3)

The objective of WP3 was to identify promising novel processing technologies that can be used to produce innovative food products, but where consumer and retailer acceptance could be an issue. Aspects of sustainability (economic, ecological and social aspects) embodied in the new products were also considered. In this connection, promising technologies were defined as technologies that are yet not implemented in practice or which still have the potential for significantly improved and/or greater application.

A list of requirements for technology profiles was drafted. In the process, the key factors that should be considered in order to introduce a novel technology to retailers, caterers and consumers were identified. These factors were taken into consideration during the following steps within this work package and were addressed as requirements for technology datasheets. These requirements include issues related to technology description (i.e. primary objectives, product examples already on the market, implementation level, working principle and legal aspects), customer-related issues, food retailing and caterer issues, food industry related issues and further references.

Discussions were held among the work package beneficiaries in order to identify novel technologies that (a) are considered as promising by the food industry but might raise the concerns from retailers, caterers and/or consumers or (b) which consumers have a special interest in. Among all the novel technology candidates considered, 15 out of 21 technologies were selected as warranting further discussion. For these, profile datasheets for food retailers, caterers and consumers were prepared based on the list of requirements.

Originally, we envisioned identifying up to 10 promising novel technologies. However, based on discussions within WP3 it was concluded that more than just 10 technologies had the potential to be of interest. The increased number of technologies enabled us to cover a wider span of technologies. The suggested promising technologies can be categorized into four main groups: (1) non-thermal processing technologies (high pressure processing, pulsed electric

fields and cold plasma), (2) novel technologies for enhancing safety (ohmic heating, infrared heating and electron irradiation), (3) structuring technologies (high pressure homogenization, shockwave technology, super critical fluid extraction and ultrasound cutting) and (4) novel packaging and storage technologies (edible coatings, active packaging, biodegradable packaging film and radio-frequency identification). See Table 2 for an overview.

Table 2: Overview of promising novel technologies

Texturising methods	Mild processing
Hydrodynamic pressure technology (shock wave)	High pressure processing (HPP)
Ultrasonic cutting	Infrared heating
High pressure homogenisation	Super critical fluid extraction (SCFX)
Electromagnetic methods	**Advanced packaging methods**
Pulsed electric fields (PEF)	Intelligent packaging
Electron beam irradiation	Radio-frequency Identification (RFID)
Ohmic heating	Edible coatings
Cold plasma	Active packaging
	Biodegradable packaging film

Each of the selected 15 novel technologies was discussed in detail and documented. It was attempted to explain each technology in a straightforward manner and to avoid advanced or complicated scientific explanations while introducing the technologies. Technology profile datasheets were all published on the RECAPT website in order to be accessible to the public.

Each data sheet provides the following information about the technology in question: working principle, implementation level (R&D, pilot, niche market, industry), examples of products already on the market (if any), benefits and shortcomings, retailer and caterer issues, expected market penetration, production costs and probable restrictions in use.

Through discussions with CFIF members, critical aspects of the promising novel technologies from the perspectives of caterers, retailers and consumers were identified. Among the issues to bear in mind when developing and launching new products that are produced or processed using novel technologies the following issues were identified: (1) price and pleasure, (2) technology naming, (3) transparency and authenticity, and (4) sustainability and packaging. Because consumers are suspicious of novel food technology, food manufacturers (along with other stakeholders) should take a holistic approach and take into account all these issues along with more technology-focused issues when introducing new technologies in order to assure consumers about these technologies' safety and associated benefits, which may not be feasible applying more traditional methods. This necessitates engaging customers from retailers and caterers to final consumers in an open dialogue to elucidate the whole objectives of the novel technologies along with their pros and cons and safety issues.

3.3 Innovation and retailers/caterers (WP4)

The objectives of WP4 were to analyse how retailers and caterers make decisions to (1) include new food products (particularly based on novel technologies) offered to them by supplier, in their assortments and (2) become actively involved in the new product development process. More specifically, we investigated

- The organisational, structural and strategic and competitive factors influencing the assortment decision making process of retailers and caterers
- The concerns held by retailers and caterers with regard to novel technologies in food products
- The role of additional information about the benefits/pitfalls of novel technologies in facilitating retailer and caterer decision making processes

Literature review

A literature review has confirmed that most work on the (retail) buying process is dated, and there is little published material on the catering sector and how processes there may differ from the retail sector. The literature review highlighted major changes in contextual factors within the sector (scale and centralisation of buying organisations, increased consumer focus with a demand chain approach, the emergence and prevalence of private brands, and the role of information and enabling information technologies in supporting this), which have impacted upon the buying process.

In terms of the buying process, the review focused on the role of the retail buyer, the criteria for product selection, and the composition, role and behaviour of buying centres. The role of the buyer has evolved beyond simply "trading" skills to encompass a wider range of product and category management considerations; the criteria have expanded to include "value added" criteria driven by consumer needs and desires (e.g. traceability); traditional price/quality/delivery criteria, whilst remaining important, are taken as a base expectation; and the composition and behaviour of buying centres has evolved to include a wider range of individuals, skills and activities, with a greater focus on a relationship rather than trading/confrontational model.

These findings and issues were presented to the CFIF participants at the 2nd CFIF workshop to elicit views on:

- the applicability of these findings to the situation today,
- to gain a supplier view of these issues (research has primarily involved asking buyers)
- the relevance of the "retail" model to the "catering" sector

Following the CFIF workshop, the issues drawn from the literature review formed the basis for conducting interviews with buyers and suppliers to confirm, triangulate and amend the understanding of how the buying process operates.

Retailer and caterer assortment adoption decision-making

There has been relatively little recent research on the buying and assortment decision-making processes of retailers and, in particular, caterers. Not surprisingly, given this state of affairs, there is also very little existing research into the impact of novel food technologies on these assortment decision processes. Hence, it has been necessary to supplement the literature review with new primary research to establish what the current assortment decision-making processes of retailers and caterers are and how they react to novel food technologies.

The purpose of this study has been to identify the activities, roles and responsibilities of different actors (manufacturers, suppliers, retailers, caterers and consumers) in the assortment decision-making processes. To this end, we have conducted interviews with representatives from 17 organisations (suppliers, retailers and caterers). In these interviews, particular attention was devoted to:

- exploring how interactions with food and drink companies and consumers influence the assortment decisions made by retailers and caterers;

- identifying the attitudes of retailers and caterers towards the product and service opportunities presented by novel food technologies;

- assessing the perceived barriers to the adoption of these new food technologies, with a particular emphasis on the role of information

In general, the retail buying process is organised on a product group or product category basis. This has important implications for the selection of new products, as the dominance of category management approaches effectively limits the opportunities for new products and suppliers depending on the prevalence and approach to private brand ranges. For example, when a private range with a clearly developed hierarchy (i.e., comprising standard, premium, low price, organic, healthy-living etc.) is presented, the total category may consist of the leading manufacturer brand, a price-fighting manufacturer brand and then a range of private brand options. In this scenario the opportunities for the selection of new manufacturer brands is limited and constrained to specific roles within the range. An additional potential constraint on the opportunities for new product adoption was identified as the growth of limited-line discount chains throughout Europe. In these chains product categories are typically restricted to one (often private) brand. Both of these trends potentially restrict shelf space and listing opportunities for new innovative products based on novel technologies.

The buying process typically starts with a category review of the retailer, which identifies gaps in the existing product range. Typically, the category review is retailer-led and entails:

- an assessment of range performance

- observations and insights from ranges carried by other retailers

- the identification of a best-in-class benchmark product

- customer opinions – often solicited through customer panels

This process identifies gaps in the product range, with the overall aim of growing sales and profitability within the category. If it is decided that a new product is needed, then either an existing manufacturer brand is sourced or a range strategy brief is drawn up and suppliers are approached to develop a product against the brief. Sometimes the potential of an idea that works well in one category is explored in other product categories. It is common for retailers and established suppliers to work together from the idea stage, through prototyping, market and marketing testing to production. All interviewees emphasized that the product gaps were unequivocally driven by customer needs, not product-led ideas or innovations per se.

A number of decision criteria were evident, and these were clearly articulated in established processes and procedures. However, a common consensus amongst the interviewees (from both the retail/caterer and supply side) was that ultimately a trading focus persists. Price is still very important in the decision-making process and costs and flexibility remain key determinants. One retailer commented that he looked at the category, considered the shelf space available and analysed the commercial margins obtained from that category. Any new product had to perform better than any product it replaced. A quote from one retailer captured this view: *"Most of all it is margins, how much money can be made with taking in new products to the assortment. It is money, money, money, not so much about quality. Sometimes it takes a long time to introduce the product and build the brand. It takes a lot of time and money."* If a manufacturer brand was introduced clear sales targets were established for 3 and 6

months time to ensure that appropriate promotion was provided by the manufacturer. From the manufacturer/supplier perspective, one interviewee commented that essentially they try to answer a basic question "*Why is it a good idea to list this product?*" and provide a business case showing projected sales, margin and profit. Another supplier commented: "*What they assess is mainly the sales. They look at the numbers and the figures and they look at how fast the product moves from the shelves and how much money they can make. If the product doesn't sell fast enough they just delist it again. That is hard-core business.*" Despite the existence of defined criteria and stages, many manufacturers, especially on the continent, felt that some degree of personal judgement was still involved in the decision. Category managers were experienced and also had a feel for the category involved. Increasingly sensory tests and consumer acceptance are important determinants in the process.

In catering a similar process was evident. Approval was largely "culinary" approval and executive chefs were key decision makers in selecting a new product. Also involved were staff from procurement – involved in identifying suppliers, providing product and supplier information; and from health and safety – who, as well as legislative compliance, kept abreast of scientific and regulatory developments. Caterers suggested that whilst price was important, quality was the key determinant. One interviewee with experience in both the catering and retail sectors suggested that this quality emphasis was a subtle difference between the two sectors. Finally, suppliers to the catering/food service sector commented that there was now evidence of a move towards considerations of criteria relating to customer experience and transparency.

A clear view expressed by interviewees was that true innovation is limited and most "new" products are in effect different "versions" of existing products, e.g., recipe variations – "*small steps not big evolutionary steps.*" This could include imitating the features of leading manufacturer brands. Consequently, innovation was typically low cost and relatively simple, as scale was needed to provide cost economies. One interviewee categorised the new product process as "*product churn,*" driven by category management and often entail changes in brand architecture, rather than major shifts within a product category. The definition of "innovation" also varied with product category. For suppliers, innovation was also about efficiency in the production process and supply chain, especially anything that shortened the supply chain and extended shelf life. As retailers seek to differentiate themselves from each other, some product innovations may be acceptable to one retailer but not to another, as they do not fit with the market position or core values underpinning the brand.

Many retailers and caterers have an internal policy list which any new product based on a novel technology is evaluated against. First, the technology must have government approval – it was very clear that the interviewees felt that it was not the role of retailers or caterers to champion a technology to legal acceptance. Aligned to this, any technology or supplier must be legally compliant and meet all legislative requirements. Irrespective of these conditions a retailer or caterer may have an internal policy concerning specific technologies. An example was provided by one retailer, which had GM products in its stores, via manufacturer brands, but a strict policy not to use GM ingredients in its own private brand products.

Food safety was a key starting point in the assessment of any novel technology, ingredient or process, and most retailers and caterers had some form of a health and food safety forum, which would typically consider safety issues but also wider issues of consumer perceptions (i.e., the commercial dimension). An example was given of a new smoked flavouring, which was deemed to be "safer" than existing options. Before being introduced, a full scoping exercise was carried out to consider food safety processes as well as flavour and sensory

benefits. Such fora would also provide an opportunity for discussion of best practice, and new technologies and processes appearing on the market.

Attitudes to novel technologies and areas of potential growth

A very clear distinction, made by both retailers and caterers, was that the key in any product introduction was not the idea itself, but the "*benefits case.*" Any product idea or innovation has to be framed as a customer benefit or customer solution in order for it to be considered. The benefit case should be established first (i.e., *what do we want*?) and then ideas of how to deliver that benefit (*how can we do this*?) should be sought. The outcome should be "*if we can do this, it would be great.*" Retailers and caterers are looking for "solutions" for customers; not technology or innovation per se.

Information about new ideas and novel technologies is derived from a number of sources. A number of interviewees commented that increasingly retailers and caterers were watching the restaurant industry for novel ideas, and then looking at ways of delivering these in a retail or catering setting. Closer contact and collaboration with suppliers, especially in the case of private brands, provides another avenue: *"We are in regular contact with our suppliers and talking to them every week or every day, we are very close. So every week they can tell us about novel food, novel packaging, novel processes."*

It was stressed by all interviewees that technology and innovation is not just about the product. Both retailers and caterers commented that innovation takes multiple forms, and companies did not distinguish between the future potential of developments with respect to ingredients, processes or packaging. All had potential value. Retailers approached suppliers seeking packaging and display solutions as much as "product" or process solutions. Although retailers frequently describe themselves as "innovative", this is often with respect to the store format, some digital technologies, and store/shopping processes, rather than in terms of product innovation, although one might argue that the store is the "product" of the retail business model. Many of the potential areas for future innovation suggested by the interviewees were focused upon changes, ideas, or solutions that might enhance the shopping process. In particular, the rapid growth of on-line shopping and ideas that might help with fulfilment related issues such as how to keep food safe and chilled during a consumer's absence were given as examples of current concerns by retailers. In a similar vein, the catering companies also discussed "shopping" innovations, but in their case this related to the display or presentation of food in canteens, and how this added to the consumption experience.

All interviewees agreed that identifying customer benefits has a number of dimensions, not least being clear about what customers actually understood and what they would accept. Understanding and managing perceptions, or perhaps more accurately mis-conceptions, was important. The benefits of any novel technology to customers have to be clear, not the specifics of the technology itself. An example given was Quorn – the consumer benefit is a healthy, vegetarian, protein which is low in saturated fat, rather than what Quorn technically is (i.e., a mycoprotein extracted from the fungus *Fusarium Venenatum*). Additionally, some retailers commented that it was important to distinguish between the shopper (who purchases the product) and the consumer (who eats the product), as both are important opinion formers but perform different roles. As one supplier commented: *"It is important to distinguish between the shopper and the consumer. The retailers would do a lot of research on the shopper, why do they shop the way they shop. The consumer is obviously the one that consumes the product. It might be the same person, but packaging and how the product sets itself needs to be presented very well in order for the shopper to pick up the product. It might be*

a fantastic product, but if the shopper never buys it, it does not get into the hands of the consumer."

Novel technologies and barriers to adoption

There was an awareness of potential novel technologies amongst the interviewees, possibly reflecting their roles and remits within their respective organisations. Retailers tended to reiterate the view that it was easier to see the advantages of technology-driven innovations around sales, rather than around products. One supplier also commented: *"Usually the retailers don't care about the technology; they just want a good product. If the technology is really something that gives uniqueness to the product that also the consumer can see a value in, it is different."*

Despite the recognised potential of novel technologies in the food chain, there are a number of barriers to the adoption in the retail and catering sector. The comments of one supplier provide a useful summary:

"What is important to understand is the unity between the suppliers and producers of new technologies, the retailers and the consumer. How these three go hand in hand. So the retailer will not put something on the shelves that the consumer does not want and consumers have a very difficult time explaining what they really want. What they say in an interview, what they think is cool to have in the fridge, might not be what they actually buy. It is understanding who the ultimate decision maker is. Is it the consumer? Or is it that technology is being kept away by retailers being risk adverse?"

Specifically, retailers and caterers see barriers to novel technology adoption in relation to: scaling up from the laboratory to full-scale production; communicating the benefits of products and technologies to consumers; and lack of "fit" with the market position of the retailer or caterer.

Communication was considered particularly crucial, as there is a view that consumer knowledge and understanding of food production and food technology is limited: levels of scientific literacy are low, and there are inherent compromises and contradictions in customer needs and wants, and which technology is acceptable. Hence, it is important to consider carefully:

- <u>what</u> to communicate to consumers: there was a view that communication should focus on consumer benefits, not technology features;

- <u>how</u> to communicate: language should be simple avoid raising concerns; and all forms of communication should be consumer tested;

- <u>who</u> communicates: as retailers and caterers are closest to consumers they must own key messages; consumers should not be patronised; and there was felt to be a role for "neutral" opinion formers.

Communication is also needed with retailers and caterers as well as end consumers – there are also knowledge gaps and misunderstandings in commercial teams.

Irrespective of customer acceptance, the novel technology may not fit with the company vision or ethos. This may be reinforced by private brand range policy and guidelines. For example, one retailer had decided not to use any products that have undergone irradiation, as it was felt that customers would deem this to be an "unpleasant" process and it was felt that a declaration on the pack would restrict purchases. Whilst irradiation was seen as a valuable process with several benefits, the retailer felt that customers needed to be educated as to

what it is about, but that was the role of the government and scientific community not the retailer. Most interviewees commented that regulatory frameworks could be barriers to adoption. Both government and NGO acceptance was important. Labelling requirements could be counter-productive, and may raise unnecessary concerns – for example enzymes that may have been used at some point in the process may have to be declared even though they are not actually present in the final product.

Channel alignment is crucial to the adoption of a novel technology. If an idea develops around a novel technology all channel members and elements must be aligned, and supplier relationships are an important contributor to this process. There is always a risk with any new product and particularly if based on a novel technology, so suppliers need to feel secure enough to invest in product development. Longer-term relationships help with the innovation pipeline and the willingness to develop and trial a new idea. An example given was if a foodstuff provider claims that a foodstuff additive will provide tastier protein, the supplier has to be persuaded, and then the supplier has to convince the retailer and the customer.

Channel alignment or channel "buy in" also relates to retailer and caterer perceptions of risk. As social responsibility and sustainability are emerging as important customer values, retailers and caterers need to be clear that primary suppliers adhere to the same values and standards. This is reinforced in an era of social media, when any discrepancies can be communicated to a wide audience very quickly.

A number of interviewees commented that ultimately the decision to adopt comes down to a straightforward cost/benefit analysis. If there is a potential public relations risk to reputation then adoption will be difficult. Brand reputation is sacrosanct to both retailers and caterers and cannot be risked.

3.4 Innovation management (WP5)

The objectives of WP5 were to identify best practice models for managing innovation in collaborative interactions between food manufacturers and retailers/caterers with a particular focus on open innovation and co-development.

Innovation models

The well-known principle 'innovate or die' emphasizes the importance of innovation for firms: they need to continuously develop and launch successful new products and services to survive. Moreover, innovation is an essential asset for differentiation and the creation of a sustainable competitive advantage. Innovation is also of vital importance for firms in the food and beverage industry in order to survive cost cutting and rationalizations. An important challenge food manufacturers face when developing new products based on novel technologies is a strong focus on price by retailers and caterers. This narrow focus on price and profit margins often results in favouring incremental innovations, as those can be developed faster and are believed to be less costly to develop. As a consequence, many companies in the food and beverage sector are now suffering from overloaded portfolios of incremental innovations, while radical innovations based on new technologies receive much less attention.

The focus on price is only one of the challenges that the food industry faces when developing new products. Consumer demands often contradict each other, and are changing rapidly. Such demands could be about mass customized (i.e., personalised) products, but also about authenticity and fresh taste as well as easy to store products. Furthermore, firms' strategies could be contradicting the 'innovate or die' principle; for example, when firms believe that

sourcing unpackaged foods does not need any innovation. Long term-success, however, is mainly gained from radical innovations, and strategies to overcome the above mentioned challenges are to focus on radical process innovations that save costs along the value chain, or on radical product innovations that deliver clear and new consumer and retailer benefits.

It is often suggested that collaborative innovation with partners inside or outside the value chain is the appropriate way to implement these innovation strategies effectively and efficiently. Indeed, also in the food and beverage industry, the number of collaborations is ever increasing. The increasing complexity of many new food products and services calls for a deeper understanding on how to manage these collaborative innovation processes more effectively. Therefore, the main question that was to be answered by this WP was: How can different partners work together to exploit promising emerging technologies in ways that deliver clear and new benefits to retailers and consumers alike? In other words, how to effectively manage the development of these emergent technologies into viable new products and services through open innovation practices?

An initial understanding of (closed) innovation management models is crucial to appreciate the benefits of collaborative innovation management, as (closed) innovation management models provide the structure that is often present in collaborative innovation management models too. The literature search identified different kinds of innovation management models: linear models, such as Stage-Gate models and many adaptations to it, and cyclical models, such as the Buijs model and Cyclical Innovation Model. For the collaborative innovation management models, we identified the "Want Find Get Manage Framework", and many adaptations of it, and classifications of collaborations. The Want-Find-Get-Manage (WFGM) framework (Slowinski & Sagal, 2010) divides the lifecycle of a collaborative innovation relationship into four stages (Slowinski & Sagal, 2010, p. 39): **Want** (i.*e.,* what are our resource needs?), **Find** (i.*e.,* how do we find and evaluate the external sources that fulfil our wants?), **Get** (i.*e.,* what processes will we use to plan, structure and negotiate an agreement to access external sources), and **Manage** (i.*e.,* what tools and metrics will we use to implement ongoing collaborative innovation relationships?).

Although these new tools for collaborative innovation management all have their benefits, they unfortunately have in common that very little is said and few examples are provided about the food industry. Further, a full understanding of the antecedents and consequences of collaborative innovation management practices in the food industry is not available yet. Case studies provided further understanding about how different stakeholders can work together in the food industry to exploit promising radical technologies in ways that deliver clear and new benefits to retailers and consumers alike. Our case study findings offered insights into collaborative innovation management in the food industry.

Case study findings

The RECAPT project identified 15 promising emergent food technologies that can be divided into four categories (see above). These technologies offer financial benefits across the food chain, customer benefits, or both. For each of the four categories, a case study was carried out in which a new food product was developed by means of an emergent technology. The technologies in these case studies sought to extend the shelf life, or to improve characteristics of key product ingredients. Manufacturers developed these technologies for a specific product category (*i.e.,* a group of related products (*e.g.,* soft fruits) or related products with different recipes, and/or different brands (*e.g.,* soups, desserts). The unit of analysis for our multiple-case study is a technology applied for a specific product category. For three (out of four) cases the technology development phase was present and thus, relevant to include in the analysis.

For one case, the technology was available to be purchased and implemented by the food product manufacturer, and thus did not need additional technology development efforts.

In each case, we conducted a series of interviews with multiple collaborating parties, including product manufacturers, technological and scientific service suppliers, machinery manufacturers, ingredient suppliers, sales agents and licensees, and retailers. The 40 semi-structured interviews included questions about the phases of the technology development and NPD processes, the collaborations, and the knowledge that was generated. Secondary data, such as brochures and press releases were included in the analysis as well. The interviews were transcribed and coded, misunderstandings were resolved with the firms, and from this process several core categories emerged. These categories are depicted in the collaborative food innovation management model (see Figure 3) and they are further explained in the text below.

The model will help firms in the food industry (and non-food firms that seek collaborations with the food industry) to become more effective in collaborative innovation management, thereby increasing the market performance of their firms. The model shows the antecedents and outcomes of a collaboration process for the development of a new food product based on an emerging technology. The "WFGM framework" (Slowinski & Sagal, 2010) structures the collaboration process. The outcomes on the right are the reasons for firms to collaborate while innovating. The antecedents on the left are the firm and other factors that influence the collaboration process of different partners that want to exploit promising emergent technologies in ways that deliver clear and new benefits to retailers and consumers.

Figure 3. The collaborative food innovation management model
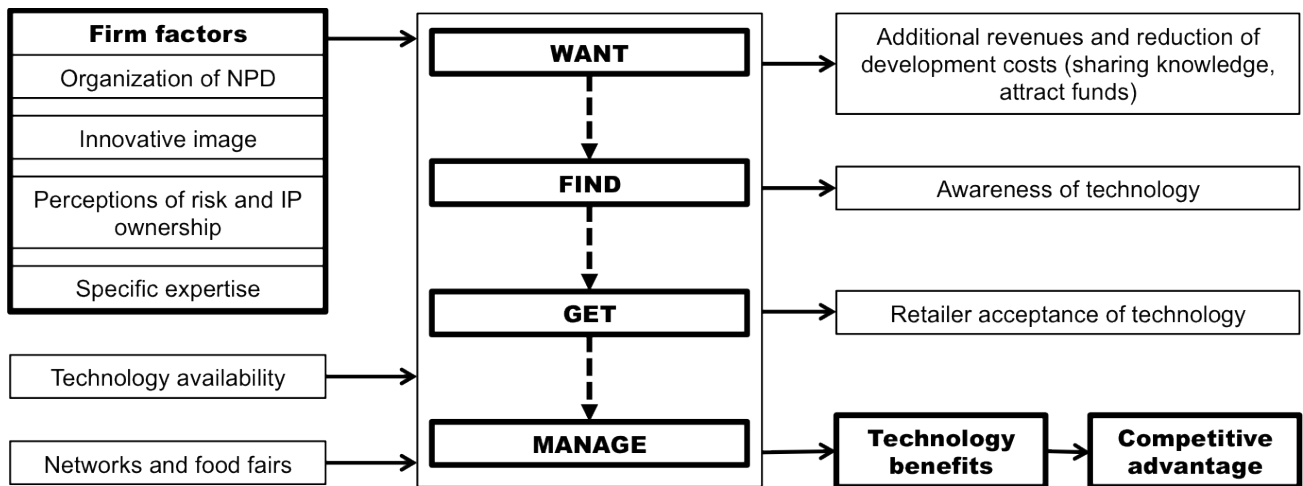
The technologies in our case studies sought to meet the demands of our interviewees of clear consumer and retailer benefits when they decided to develop a new product based on one of the emergent technologies. They often stated that the major consumer benefits of those technologies are fresh and healthier products without additives and with better ingredients. For the resellers of these products, the benefits were described more extensively. The most prevalent one was cost saving due to an extended shelf life. Sometimes, these financial benefits were flowing back to product manufacturers, as they would receive a premium price for their new products. Other benefits of the new technologies for the retailers are access to new products (reinforcing their innovative image), unique products (in case of preferred

supplier contracts), and fresh and authentic products; hence meeting consumer needs. The new products all improve the retailer's product portfolio. On the store level, extended shelf life sometimes makes it possible to move products from the freezer to more accessible and product category relevant locations (for example, frozen meat can now be sold from the chilled meat department).

Food manufacturers expressed various reasons to seek knowledge about new technologies that could potentially improve ingredients, or extend the shelf life without additives. Multiple manufacturers wanted to develop new markets (sometimes abroad), yet deliver on the freshness promise of their current products. One of the market development benefits of the new technologies was unforeseen and stumbled upon during technology development. Due to changed product characteristics, the product manufacturer gained access to new markets without a need for temperature control during distribution. Especially for large countries in which the focal product category is popular, this proved to be a great benefit.

Next to access to new markets, the new technologies offered opportunities for cheaper distribution. Cost savings on the side of the product manufacturer were important reasons for technology implementations. Interestingly, to some extent, the chain also benefitted from these cost reductions due to mandatory sales renegotiations because of the new technology in the product. Furthermore, manufacturers indicated that the new technology met retailers' requests for less waste, and also allowed manufacturers to meet their own sustainability goals. Less waste due to extended shelf life and unique recipes due to improved ingredients were both mentioned as important differentiation opportunities. A final reason for implementing the new technology in the manufacturing of new products was to gain experience with the technology. This experience was sought to explore new business models and to increase awareness and acceptance of the new technology.

Firms typically followed the classical phases of experimentation and solution generation, development and manufacturing, and commercialization. As we focused on cases that had implemented an emergent technology in food products, we identified a technology development phase that included experimentation and solution generation activities for the new technology. Typically, during technology development, firms developed lab scale and pilot scale facilities and explored suitable product categories to apply the new technology. During the next phase, the actual NPD phase in which product recipes were developed and improved, concurrent technology development took place. The technology was further developed (*i.e.,* optimized) for specific applications, and manufacturing was involved in up-scaling the technology for mass production. When the product met all criteria for launch (such as consumer test approvals, positive beta testing results) the new product was introduced on the market, often with great success.

The case companies followed the typical NPD process, yet the boundaries of these phases were not always clear. Concurrent engineering often took place, which was enabled by facilities of the collaborators. For example, the use of the collaborator's pilot-scale facilities allowed for building full-scale manufacturing lines while pilot scale set-ups and product recipes were still under development.

Furthermore, learning-by-doing and iterative steps were needed to optimize the new technologies. For example, various applications of a new packaging technology led to improved system configurations. In addition, iterations were anticipated to keep the momentum of the NPD project.

Knowing the innovation models used in our four cases and the firms' reasons for collaboration, we can now answer the main question to be addressed in this WP: How can

different partners work together to exploit promising radical technologies in ways that deliver clear and new benefits to retailers and consumers alike? To answer this question, we will use the "WFGM framework".

Want. In the initial phase of a potential collaboration, firms need to decide on sought capabilities and to obtain full internal commitment to the objectives and terms of a possible alliance (Slowinski & Sagal, 2010). In food, sought capabilities typically relate to ingredients, processing, or packaging. The firm needs to decide whether the capability would be developed internally, acquired with a partner, or purchased, which is not a straightforward decision given the newness of some technologies. This important decision depends on *technology availability*, and *organization of NPD* (e.g., desired IP, time goals and costs (return on investment, but also availability of personnel and management)).

In the Want phase, a lack of internal structure and commitment is a classical issue that, if not appropriately dealt with, will result in major problems in the Manage phase. A good *organization of NPD* is key here.

Out-licensing, a typical open innovation decision, can also be regarded as a typical "want" decision, that is driven by the *organization of NPD* and should result in *additional revenues*. The capability sought here would be the ability to create more technology value for different applications. In our cases, we identified several examples of out-licensing. Important issues in our cases were technology mindedness of the licensees, and situations arising from mergers, product qualities, and specific licensing conditions.

Find. Once a firm has decided what technology to look for, how to acquire it, and internal commitment on this decision is ensured, the scouting can start (Slowinski & Sagal, 2010). Our focus was on emergent technologies, and it appeared that the number of available partners tended to be low, which can be explained as facilitating the scouting process (*i.e.,* an inevitable marriage, without competitors), or the opposite (*i.e.,* hard to find). Technology knowledge suppliers and project management partners were found both in the food and non-food industry, which suggests a need for a broad scouting strategy. Given the specific capabilities sought about the new technologies, scarcity of knowledge led to multiple non-food technology knowledge partners. Specific requirements for capabilities of an external project management agency led to a non-food project management agency.

Due to the innovative nature of many projects that we studied in the food sector, one of our important findings is that knowledge is often found outside the food industry. For these non-food companies, it is important to understand the differences between the food and their own industries, and the presented model should facilitate this understanding too.

To elucidate the scouting question of how, who, and where to scout, we found that a firm's image is very important. Multiple product manufacturers and other partners referred to the image of the potential partner or of themselves as reasons for contacting or being contacted. Interestingly, the geographical location of a partner was also mentioned as an indicator of a positive image: if a partner firm is responsible for the majority of all jobs in the villages around the firm, they will be a reputable firm.

To answer the question where to scout, *existing (personal) networks, but also food fairs* were mentioned in all cases. Networks ranged from current business networks to personal relationships going back 20 or more years in time. For the current business networks, preferred suppliers, such as software and machinery suppliers were chosen because better deals can be arranged when accounts get larger, negotiations are often faster, which saves overhead costs. Furthermore, prior projects, sometimes during former engagements, served

as a pool of potential partners. Next, personal networks were mentioned often, and mostly in the context of start-up firms, due to the limited resources of these firms and their desire for efficiency.

Get. The get phase is about formalization of the collaboration and deciding what kind of collaboration it will be (Slowinski & Sagal, 2010). One well-known hurdle in this formalization process is *IP ownership*. Proper o*rganization of NPD* enforces agility in functional roles and agility in business model development, which facilitates the decision on the kind of collaboration. Furthermore, in the Get phase, a process needs to be installed that monitors whether the kind of chosen collaboration is satisfying or needs updating, and in our cases market introduction trials are such a process.

Aligning perceptions of risk sharing and IP ownership are key antecedents for all kinds of collaborations. Multiple product manufacturers stated that the partner who invests and takes *risks* developing the technology should be allowed to continue working with it.

Manage. In the manage phase, implementation of the collaboration activities is key (Slowinski & Sagal, 2010). The firms implement the agreements of the alliance and coordinate all activities. Implementation hurdles ranged from practical matters, such as seasonal availability of produce to use in a trial, personal conflicts, not sharing supposedly crucial information, to misunderstandings related to not being familiar with food. Multiple cases out-sourced the coordination of the activities to external project management companies.

Non-food partners (identified in the Find phase) offered the sought capabilities but often lacked knowledge of food regulations regarding, for example, hygiene during technology and product development.

Project management is always important, yet if a business usually innovated incrementally, project management skills regarding full transformation of manufacturing lines were underestimated. Typically, after 1970, internal project management departments became obsolete, as the post-war asset base was set up and running. In our food cases, the product category was not new to the product manufacturer. The products manufactured with the new technology did not look any different on the outside, nor required a new business unit. Thus, people who were used to developing innovations that were more incremental than the ones we studied also worked on the radically new products. Not only was this apparent during product and technology development but also during deployment of the manufacturing line. Project management underestimated instalment activities and training efforts of operating staff.

Especially in the food industry, collaborative innovation with emergent technologies offers great possibilities for firms. Through the collaborative approach, firms are able to develop technologies that were unlikely to be developed by these firms alone.

Thus, a shift to a coalition of experts is present, where experts are from both the food and non-food industries. This makes the management of the NPD processes more complex. Multiple parties with multiple interests need to be managed well. The WFGM framework provides guidance on how to implement radically new technologies that offer benefits to many parties in the value chain, including consumers.

Developing a successful portfolio of new food innovation projects

Building a successful innovation portfolio is a challenge for many firms in the food value chain. Common problems that firms in the food sector and elsewhere encounter are overloaded portfolios of incremental innovations that are confusing for retailers and consumers alike, and fire fighting where innovation managers are too busy solving small and unforeseen problems rather than implementing the innovation strategy of the firm (Repenning, 2001). This is an unfortunate situation, as successful innovation portfolios have been empirically linked to the market performance (e.g., customer satisfaction, market share, and profit) of many firms in diverse industries, including the food sector (Kester *et al.*, 2014). Building on the growing literature on innovation portfolio management (e.g., Cooper *et al.*, 1999; 2001, Kester *et al.*, 2011; 2014), and on our qualitative case study results from four new food product development projects based on emergent technologies, we developed an innovation portfolio tool that will help firms in the food sector to become more effective in portfolio management, thereby increasing the market performance of their firms. Figure 4 presents our food innovation portfolio tool.

Figure 4: Food innovation portfolio tool
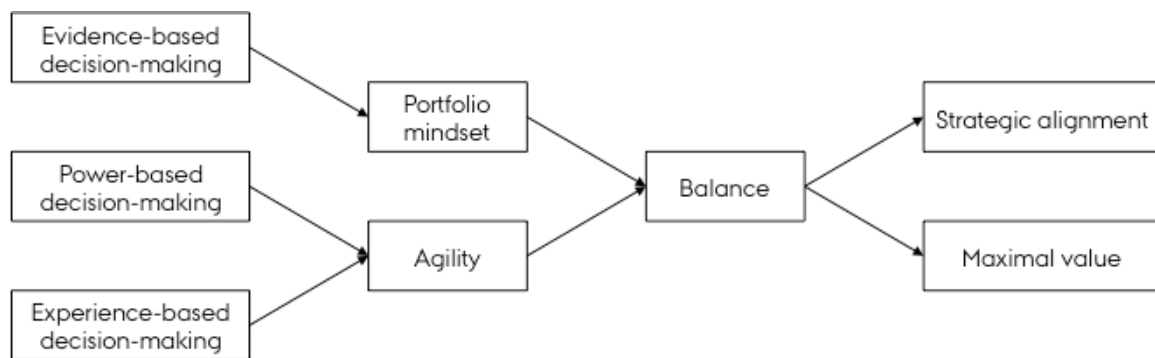
Successful portfolios are balanced, strategically aligned, and provide maximal value (Cooper et al., 1999; 2001). Balanced portfolios are harmonious with respect to specific parameters, such as product newness and their risk/reward characteristics. Hence, firms with a balanced portfolio have an optimal spread in individual project risk (e.g., a good balance between incremental and radical innovations), and the right number of projects for the available human and financial resources. Firms with innovation portfolios that are strategically aligned have an innovation portfolio composition that reflects the firm's business priorities; each innovation project individually supports the firm's articulated (innovation) strategy. Finally, maximal innovation portfolio value is defined as allocating resources to maximize the overall value of the portfolio in terms of profitability, or likelihood of success. Interestingly, the most important characteristic of innovation portfolio success is balance. Kester et al. (2014), as well as our own case study data, thus show that firms with unbalanced innovation portfolios have great difficulty to align the innovation portfolio to the firm's strategy, and to achieve an innovation portfolio that delivers maximal value. For example, one of our case study participants stated:

> *"So, along the way, as an innovation company you start to reflect. What is the best business model and how will we generate a steady stream of revenues, with your complete assortment, some specific products. [...] or with specific customers. The*

assortment that you launch on the market depends on the needs of the consumer; that is what it ultimately comes down to. But you also look at the sourcing possibilities. You check your network for products that have been developed and that you could sell."
- Commercial manager, product manufacturer case B

Successful innovation portfolios (in terms of balance, strategic alignment and maximal value) result from effective decision-making processes. Two important characteristics of effective portfolio decision-making processes are having a portfolio mindset, and agility (Kester et al., 2011; 2014). A portfolio mindset means that the firm has a complete overview of the entire innovation portfolio, as well as in-depth knowledge about each individual NPD project. Agility means that a firm is quick and flexible in making innovation portfolio decisions. Kester et al (2014) and the results from our case studies indicate that both a portfolio mindset and agile decision-making increases the success of innovation portfolios, particularly in terms of portfolio balance. For instance, our case study informants claimed:

"[…] this product is part of our assortment, and we have faith in this product for the future. But it is not like I am daydreaming all day about this one product. It is one of our products with future potential." - Commercial manager, product manufacturer case B

"The first analysis is about the portfolio. You look at the benefits of the new idea from a technological perspective, and you look at the other ideas within brand management, and with which brands should we implement innovations because we have not implemented anything for a long time. Which brands have issues, which are going well and can still grow, which external trends do we see, so you look at it from two perspectives: there are technological ideas and marketing ideas and we look for the best fit." - R&D, product manufacturer case A

Effective portfolio decision-making is the result of three types of decision-making processes: evidence-based, power-based, and experience-based (Kester et al., 2011). Evidence-based decision-making is based on objective information and empirical evidence to build a decision-making rationale. Power-based decision-making allows powerful groups (e.g., production or marketing) or individuals to make portfolio decisions that reflect their own interest. Experience-based decision-making is based on personal experiences to build a (subjective) decision-making rationale. The qualitative results from Kester et al. (2011) and our own multiple case study data indicate that evidence-based decision-making is particularly helpful to develop a portfolio mindset, whereas power-based and experience-based decision-making are useful for making agile portfolio decisions. It is important to note that all three decision-making processes have their advantages and disadvantages but that all three of them are necessary to make adequate and timely portfolio decisions. The final quote below illustrates this reasoning well:

"If you take a look at our product assortment, there is neither rhyme nor reason in it. The theme is the technology that should be able to be applied. Why do we need these processed products? Because we gain experience with the technology." - Commercial manager, product manufacturer case B

4 Potential impact

RECAPT contributes to the Knowledge-Based Bio-Economy (KBBE/Food, Agriculture and Fisheries, and Biotechnology) under Activity 2.2: Fork to farm: Food (including seafood), health and well-being. Sustainable, innovative food production is supported through the involvement of the central actors in the food chain: food science, technology providers, food industry, retailers and caterers. The project has been particularly focused on stimulating the participation of the retailing sector, which represents an important sector of the European economy (11% of the EU's GDP).

- **Consumer acceptance of novel technologies**

RECAPT has identified three paths to consumer acceptance/rejection for promising novel technologies:

1. *The product attribute evaluation path* is the central route to consumer choice. Here technology allows the production of products with <u>attributes</u> that are valued by consumers, leading to inductive inferences (bottom up) of quality and choice.

2. *The technology apprehension path* is a path where unfamiliarity and dread may lead to negative <u>socio-political technology attitudes</u>, which may in turn lead to categorical rejection. Alternatively, positive attitudes such as those towards naturalness may support product choice by reducing the consideration set of alternatives to only natural products. Besides limiting the choice of products, socio-political attitudes may also provide top-down, deductive inferences (top down) towards the product evaluation.

3. *The retail/caterer service path* is related to <u>service attributes</u> of retailers and caterers that are enabled by the characteristics of novel technologies. For instance, technology attributes may allow novel retail and caterer business models, product placement and customer relation services. Such business models may result in inductive inferences (bottom up) about product attributes and thus the product as a whole, or may result in changes in store image that affect choice directly.

The three paths to consumer acceptance identified in the model require managerial attention because, although the roads may lead to consumer adoption, they can also represent barriers. The three paths have been the basis for the development of a new technology acceptance checklist, which is a managerial tool that is freely available to all actors in the food chain. This tool can be used both in risk assessment in the context of new product development projects and in the proactive search for new innovation potential.

- **Managerial challenges**

The challenges facing the European food and drink sector, the emerging trends in consumer demands and the three roads to consumer acceptance of produced based on novel technologies can be translated into three main managerial tasks:

1. *Creating customer value.* The immediate task for managers is to create customer value from promising novel technologies by addressing traditional and emerging consumer demands. This requires a solid understanding of consumer demands and good abilities in cross-functional cooperation. RECAPT has collaborated with CONNECT4ACTION to bring about tools that can facilitate this process.

2. *Managing the competitive context.* Managers have to reflect on how they can influence and manage the competitive dynamics within their supply chains and on the business-

to-business markets on which they operate, e.g. through collaborative innovation between manufacturers and retailers and caterers. RECAPT has developed a framework that actors in the food chain can use manage collaborative innovation projects and in this way better exploit the potentials of emerging technologies.

3. *Managing relationships with society*. It is important to manage relationships with diverse stakeholder groups and to reflect on the process of technology acceptance in society at large in order to gain acceptance for novel technologies from consumers and other stakeholder groups.

Given the changing nature of consumer demand, a strong market orientation of the entire food chain is essential for successful innovation and the development of products and service that create value for consumers, while taking into account the competitive dynamics and societal concerns about the consequence of novel technologies.

- **Future collaboration between food researchers, food industry retailers and caterers**

The Collaborative Food Innovation Forum (CFIF) was central to the RECAPT project (see Figure 1). The objective behind establishing the CFIF was to create a platform for effective dialogue and collaboration between food chain actors that could serve as a basis for delivering innovative, novel or improved products and services to support the competitiveness of the European food and drink industry. With the CFIF we have, firstly, offered members information on emerging food technologies, consumer acceptance of novel technologies, retailer and caterer perspectives on innovation and novel technologies, as well as on current collaborative innovation management practices. Secondly, the CFIF has provided connectivity in order to support collaboration among food scientists, food producers, retailers, caterers and consumers for the creation of knowledge-sharing networks and new relationship models in the development of innovative food products and services.

There have been three meetings of the CFIF, respectively focusing on (1) consumer trends and promising novel; (2) retailer and caterer assortment adoption decision processes; and (3) innovation models and adoption decision-making in the food sector. These meetings have all demonstrated that the idea of bringing together different stakeholders in a neutral setting is sound, as the different views of various stakeholders have stimulated fruitful discussions among stakeholders and that have helped focus the work done in RECAPT.

The CFIF provided a basis for trust-building and cooperation in the food sector. Together with CONNECT4ACTION, we will build on this basis by creating a joint LinkedIn group. Both CFIF members and members of the existing Connect4Action LinkedIn group will be invited. This will enable us and the stakeholders involved in RECAPT and Connect4Action to maintain ties that can be rejuvenated in the future. Also, this LinkedIn group can serve as a dissemination channel for future projects and to discuss issues of relevance to its members.

- **Opportunities and challenges for collaboration**

The combination of changing consumer demands, global markets and new technological opportunities present the food industry with possibilities for innovation and growth. But there are also challenges related to the need to be aware of and have access to novel technologies, to understand the changing consumer and to get past the retail gatekeeper.

The research conducted as part of RECAPT suggests that retailers and caterers are aware of emerging technologies in food production and processing[1]. However, it may not be clear to those involved in innovation and new product development how these technologies can create added value for retailers, caterers and end consumers. Furthermore, the competences needed to exploit those technologies may not exist, or the right partners

Furthermore, as has been demonstrated by the research on retailer and caterer adoption decision-making in RECAPT, it is important not to get blinded by the technology but to combine it with insight into consumer needs and wants in order to ensure that the new technology provides benefits to consumers.

Innovation and new product development activities should incorporate consumer insight when possible. This is easier said than done, however, as at any point in time it is unclear in which way consumer needs and wants are moving. Consumers may or may not embrace the use of a new technology. Especially in the food area, many European consumers are apprehensive of new technologies. Furthermore, consumers are seemingly ignorant of the many technologies and techniques that are also involved in making traditional food products. Even when they have been identified, turning consumer needs and wants into product concepts and physical prototypes is fraught with difficulties. Companies may be lacking the right instruments for screening and testing new product concepts and prototypes.

The final challenge is to gain retailer and caterer cooperation. Retailers are in some ways conservative, especially with regard to their own private labels. Retailers and caterers are focused on protecting their reputation, and hence not inclined to take chances with new products produced using novel technologies if these technologies are viewed as controversial. As a consequence it is difficult to get shelf space for new products, a difficulty that is exacerbated by the growth of limited line discounters.

In cases where a technology is considered to be potentially controversial (cf. the technology apprehension route to consumer acceptance mentioned above), retailers are more inclined to list products marketed under manufacturer brands. Retailers may pre-empt expected negative consumer reactions and it this way block the use of promising novel technologies.

What is clear from our study is that retailers and caterers will not buy a new product just because it is produced using novel technologies. Novel technologies have to solve a problem for consumers and deliver consumer benefits. Ultimately, what products are listed is a commercial decision – it has to make business sense to the retailer.

New product introductions are costly – both in terms of development and marketing cost, but new products have to prove their value quickly when introduced. Because consumption patterns are sticky and change slowly, this is a challenge as new products are only given a brief window to prove themselves on supermarket shelves and in food service outlets.

When developing new food technologies it is important to take into account consumer perspectives and to anticipate concerns that consumers might have about the technology. More importantly, it is important to consider how an emerging technology can help create value for the consumer. In this connection, one concern could be to consider how the technology fares in light of the responsibility and authenticity trends discussed earlier.

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[1] Burt SL, Esbjerg L, Pearse H, Glanz-Chanos V (2014). Retailer and caterer decision-making processes and concerns in relation to novel technologies. RECAPT D4.2/4.3/4.4.

Consumers can see technologies as being either good or bad. Good technologies are those that are viewed as authentic, responsible, familiar, transparent or artisanal. Bad technologies are those that are seen as industrial, hi-tech, complex, unknown and scary, with genetic modification and food irradiation being iconic examples. In this connection it is important to keep in mind that at the outset emerging technologies such as electromagnetic processes, mild processing or texturizing methods are not either inherently good or bad.

Consumer science has developed an elaborate toolbox for understanding consumer preferences and decision-making that can be put to good use in the innovation process. In this connection, it is our view that food manufacturers are not demanding enough when commissioning consumer research, and as a result much of the work done by market research companies does not live up to scientific criteria.

Retailers are often seen as inhibitors of innovation – especially by food industry, but in many ways it is more productive to see retailers as a test lab. Retailers themselves acknowledge that they rely on food manufacturers for new innovations. In our view, there is significant potential for food manufacturers, retailers and consumer scientists to work more close together in order to bring about better and more efficient testing of new products.

RECAPT has made a major contribution in developing and promoting this enlightened view on the potential of collaboration. As was evident at the RECAPT final conference, there is now an increased awareness of these potentials and an increased interest in pursuing collaborative innovation.

- **Retailer and caterer adoption of novel technologies**

RECAPT has brought about much needed update of insights into the way in which retailers and caterers make decisions to adopt new products embodying new technologies. The main underlying issue was put quite succinctly in one of our interviews:

"What is important to understand is the unity between the suppliers and producers of new technologies, the retailers and the consumer. How these three go hand in hand. So the retailer will not put something on the shelves that the consumer does not want, [but] the consumers have a very difficult time explaining what they really want. What they say in an interview, what they think is cool to have in the fridge, might not be what they actually buy. It is about understanding who the ultimate decision-maker is. Is it the consumer? Or is it that technology is being kept away by retailers being risk averse?"

The main issue for retailers in relation to new products based on novel technologies is identifying and understanding what the benefits are to consumers (and themselves); they are not interested in the technology as such. Therefore, when suppliers approach retailers with a new product they have to be very clear on what consumer need or value it satisfies (or perhaps creates), but also they must identify the benefits to the retailer in terms of increased revenue and perhaps enhanced reputation.

There are a limited number of slots/spaces for new products on the shelves of retailers, something that is exacerbated by the proliferation of private brands and the growth of discounters as these retailers have a narrower assortment than supermarkets and hypermarkets and are in general very focused on private brands.

Retailers do not see themselves as first-movers. They are – quite unashamedly – followers, although fast-followers, who prefer to move incrementally rather than in big evolutionary leaps. It is easier for suppliers to have line extensions or tweaks on existing products accepted by retailers than radically new products. Retailers are particularly risk averse when it comes

to their private brands: They do not want to take a financial and reputational risk with novel, unproven technologies that might stir controversy.

Retailers and caterers do not see it as their role to champion new technologies – this is left to manufacturers and authorities. It is therefore very important that brand manufacturers take the lead in innovating on the basis of novel technologies and that they back the introduction of the resulting new products.

The retailer buying process is in theory quite rigid: new products have to pass a number of hurdles in order to get selected. In this regard, it is important that suppliers understand and satisfy the detailed briefs of retailers and that they meet the specific criteria, standards and auditing procedures of the retailers and caterers they are targeting.

Retailers are seeking differentiation in a crowded marketplace, but are perhaps more interested in shopping innovations than product innovations, as consumers can soon find identical (or similar) products in competitors' stores. Through shopping innovations retailers strive to attract customers to their stores, and encourage shoppers to buy more and return. Retailers will not do anything that threatens sales or their reputation.

It is easy to see retailers and caterers as villains in relation to radical innovation in the food sector. It is clear that they are often conservative and risk averse when it comes to radically new products or products based on novel technologies that might be controversial. On the other hand, they can also be seen as the caretakers of consumer interests, and seek to differentiate themselves from one another. Retailers in particular are very focused on what the benefits of novel technologies and the new products they enable are to consumers (and to themselves). They are not focused on the technologies themselves, something that food technologist sometimes are. Retailers and caterers thus play an important role in ensuring that there is a link between new technologies and benefits to consumers – translating the science into solutions. The RECAPT project has made this role of retailers and caterers transparent to all actors in the food chain and hopefully has paved the way for a fruitful collaboration among food chains actors in the future.

5.   Project website

The project website can be found at http://www.recapt.org

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