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Identifying the Strategic Options for Food Innovation

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1. Introduction

When it comes to food innovation, producers, caterers and retailers face a dilemma. On one hand, identifying strategic options and investing in food innovations is essential to satisfying consumers´ evolving needs and for the long-term growth of the company. On the other hand, operational changes, innovation costs, and the existing habits mandate a focus on current products and short-term results. However, in order to keep up with consumer emerging needs and for substantial growth in the long run, innovations are required and new technologies are often central to making a product innovative.

In deliverable D.2.1, we identified the emerging consumer wants and needs through a review study of food consumer behaviour literature. In deliverable D2.2, scientific studies on several promising food technologies identified in Work-package 3 were collated and summarized; furthermore, a checklist of crucial features hindering or stimulating consumers' acceptance of foods based on these technologies was discussed. In this deliverable, we aim to identify how the selected technologies may work as drivers for identifying strategic options for innovation that are expected to meet producers', caterers' and retailers' approval and stimulate the development of collaborative food systems while responding to the existing consumer trends.

Specifically, the objectives of this deliverable are:

- To discuss promising technologies as drivers of strategic options for the Collaborative Food Innovation Forum (CFIF) by applying insights from D2.1 and D2.2 and from the first CFIF Workshop held in Paris, in October 2012
- To assess the selected technologies against the trends and emerging needs identified in D2.1 and respectively the workshop participants´ opinion
- To provide information which should be relevant for all members of the CFIF

2. Identifying promising technologies as drivers of strategic options for food innovations

In October 2012, representatives from the food and drink industry (manufacturers, retailers and caterers) from different European countries came together in the RECAPT project for the First Collaborative Food Innovation Forum workshop on challenges facing the European food and drink industry. The objective of this forum was to discuss four promising classes of technologies, and align them with consumer trends, with the aim of identifying strategic

options for food innovation and stimulating the development of collaborative food systems. Some technologies were not radically new (e.g. RFID); however, they were discussed from the perspective of developing new products and services in the food sector in order to satisfy classical and new consumer needs. Likewise, while these technologies may offer significant benefits for consumers and retail industry in general, they may also raise privacy, environmental, health and other type of concerns. This report summarizes the discussions and highlights the concerns raised by the participants.

We collected information from the stakeholders on four main issues:

- How do emerging technologies satisfy "classical" consumer needs?
- How do emerging technologies satisfy "new" consumer needs?
- Which emerging technologies will elicit consumer attitudes?
- How can emerging technologies improve retailer and caterer efficiency and effectiveness?

The answers to these questions (both, individual evaluation and group discussions) were translated into a matrix format presented in Table 1.

According to discussions, all four groups of technologies are promising, where advanced packaging methods and mild processing technologies are expected to show the greatest potential in terms of consumer acceptance. There are several benefits for manufacturers, retailers, caterers and consumers that make these technologies suitable to be considered as possible drivers of high-valued strategic options for food innovation. We briefly describe each type based on the previously reviewed literature (D3.3), assess them against the emerging consumer trends identified in D2.1 and summarize the group discussions about these technologies.

Table 1. Summary of stakeholder responses regarding the emerging food technologies and their implications for consumer benefits and acceptance

	How do emerging technologies satisfy "classical" consumer needs?	**How do emerging technologies satisfy "new" consumer needs?**	**Which emerging technologies will elicit consumer attitudes?**	**How can emerging technologies improve retailer and caterer efficiency and effectiveness?**
Electromagnetic methods	Lower prices/value for money (3) Freshness (6) Taste (4) Food structure/texture Food safety Greater variety Shelf life (2)	Authenticity More natural Sustainability (e.g., energy efficiency, less chemicals) 3 Hyper-nutritional elements (less loss)	Electric – (4) Ohmic – (2) Freshness + Product safety +/- Environmental safety – Alternative to chemicals + *Acceptance difficult*	Shelf life (7) Efficiency/logistics 6 Safety Freshness
Texturizing methods	Sensory food quality (7) Reliable quality Freshness Appearance Value for money	Authenticity Clean labelling Sustainability (3) Convenience (4)	Appetizing + Mechanical=natural + Product safety an issue Just amending, not adding + *Acceptance difficult*	Efficiency (2) Shelf life (2) Value for money/lower prices 3 Improved quality Consumer satisfaction
Mild processing	Freshness (2) Food safety Sensory food quality (4) Shelf life	Clean labelling (2) Health (3) Authenticity (2) Sustainability Shelf life	Risk of technology – Sustainability + Product safety an issue (2) *Acceptance less difficult* (although some disagree) Mild +	Shelf life (6) Less storage Food safety (2) Clean labelling New retail concepts
Advanced packaging methods	Freshness (2) Product quality Taste Preserve food Purity Convenience (9)	Sustainability (biodegradable) (2) Food safety (3) Health (2) Extended shelf life Effective chain Less waste (3)	*Most will be accepted*, although privacy concerns is an important issue with RFID Consumer empowerment	Freshness indicators (consumer information) (3) Improved communication Food safety Convenience (2) Efficiency/logistics (7) Shelf space management Product presentation Improved quality New retail concepts Competition through service

Note: Numbers in brackets indicate the number of times a particular issue was mentioned.
Source: Position paper D1.5 and D1.7

3. The promising technologies as drivers of strategic options to satisfy consumers´ needs

3.1. Electromagnetic methods

The electromagnetic methods selected were ohmic heating, infrared heating, and electron irradiation.

O*hmic heating* is used for food processing with different objectives, such as: sterilization, pasteurization, heating, fermentation, peeling, dehydration, etc. The products obtained with this technology can satisfy consumer needs for health as the technology is designed to preserve the vitamins much better than the conventional heating technology, and respectively, for pleasure where ohmic heating aims to preserve the original sensory characteristics.

Infrared heating is used for food processing and has the ability to heat food without direct contact with the heat source. Apart from food safety, other consumer benefits associated with this technology may be required in order to be a promising technology.

Electron beam irradiation is used for pasteurisation of food products, inactivation of pathogens and sterilization of packaging materials, and phytosanitary treatment of agricultural products. The products obtained with this technology may satisfy consumer needs for pleasure and health as the technology is aimed to produce fresh-like products, with good flavour and colour retention, and no loss of nutrients. By applying this technology no chemicals are used for preservation of fresh foods (sustainability).

Table 2. The electromagnetic-based food innovations against the consumer trends

Electromagnetic methods	**Implemented in the market**	**Satisfying the following consumer needs for:**				
		Health	**Convenience**	**Pleasure**	**Sustainability**	**Authenticity**
Ohmic heating	Not in the market	+		+		
Infrared heating	Implemented in some food categories					
Electron beam irradiation	Implemented in some food categories	+		+	+	

Workshop participants´ point of view:

The workshop participants believed that consumers might have difficulties in understanding the electromagnetic technologies, as these technologies are difficult to communicate. One of the participants in the workshop argued, for example, that consumers are not able to understand the benefits of such technologies as irradiation or ohmic heating. From the business point of view, the participants in the workshop agreed that the electromagnetic methods can improve the distribution system and reduce waste by extending the product shelf-life, while offering to consumers increased safety and freshness.

3.2. Texturizing methods

The texturizing methods discussed during the workshop were high-pressure homogenization, shockwave technology, super critical fluid extraction and ultrasound cutting.

High-pressure homogenisation (HPH) technology is used to form and stabilize fine emulsions. The products obtained with this technology can satisfy consumer needs for safety by assuring microbial inactivation, and, health by enabling the use of less fat and maintaining creaminess in some food categories, thus offering a healthier option to consumers. In addition no legal issues are expected regarding the regulation of this technology (D3.3).

Shockwave technology is a novel postharvest tenderization technique in which ultrasound high-energy shock waves in water causes instantaneous tenderization of meat. There is one main consumer benefit associated with this technology: increased pleasure due to tender meat and uniform tenderness, and little negative impact on other meat quality traits such as water-holding capacity, juiciness, flavor, and fresh meat colour (D3.3).

Super critical fluid extraction is a technology that allows producing healthier products by removing of undesirable components. It may thus satisfy the consumer needs for healthy food.

Ultrasonic cutting is a technology, which enhances the cut surface quality, lowers the energy for cutting and improves the cut exactness. There are not direct consumer trend-related benefits associated with this technology; however, it satisfies producer´s needs for improved cutting quality and precision and reduces product waste (sustainability).

Table 3. The texturising-based food innovations against the consumer trends

Texturizing methods	**Implemented in the market**	**Satisfying the following consumer needs for:**				
		Health	**Convenience**	**Pleasure**	**Sustainability**	**Authenticity**
High pressure homogenisation	Not in the market	+				
Shockwave Technologies	Not in the market			+		
Super critical fluid extraction	Implemented in some food categories	+				
Ultrasonic cutting	Implemented in some food categories				+	

Workshop participants´ point of view:

The workshop participants believed that texturizing technologies might offer good opportunities for improved quality perception and fat replacers. The shockwave for meat tenderization may be a nice case to be explored, although there is high risk of negative perceptions from consumers point a view. As with all the other technologies, the correct communication plays an important role. The participants claimed for proactive transparency, building consumer trust and good reputation about these technologies. Moreover, according to the group discussions, some of these methods allow for more sustainable products at low cost (a benefit for the consumer).

3.3. Mild processing methods

Improving quality attributes and developing totally new products are the two types of innovation that correspond to incremental and disruptive product innovations in the food industry. The electromagnetic methods and texturing methods offer concrete benefits for new product development and enhancement. The mild processing methods discussed during the workshop were high-pressure technology, pulsed electric field technology and cold plasma.

High pressure processing (HPP) aims to inactivate the microbes and/or enzymes or to change food attributes in order to obtain consumer-desired qualities. In addition to safety, the innovative products based on this method can satisfy consumers' needs for naturalness as it is minimally processed and implies no chemical additives (sustainability).

Pulsed electric field technology is a method for preserving liquid and semi-liquid foods by microbial inactivation. The products obtained with this technology can satisfy consumer need for safety, and in addition it assures fresh-like products with enhanced organoleptic and nutritional quality (preserving vitamins), no chemical additives (naturalness), and

sustainability as it is energy efficient and waste-free. However, according to some research, consumer acceptance of PEF might be an issue.

Cold plasma is non-thermal surface sterilization of plastic, glass bottles and cans before filling. The innovative product based on cold plasma can satisfy consumer needs for food safety, which is an implied need and therefore not included in Table 4. In practice, if the benefits of this technology are well communicated, cold plasma may also be associated with sustainability perceptions as it is energy efficient (D3.3).

Table 4. The mild processing technology-based food innovations against the consumer trends

Mild processing methods	**Implemented in the market**	**Satisfying the following consumer needs for:**				
		Health	**Convenience**	**Pleasure**	**Sustainability**	**Authenticity**
High pressure processing (HPP)	In the market in some food categories	+			+	
Pulsed electric field	In the market in some food categories	+	+	+	+	
Cold plasma	In the market in some food categories				+	

Workshop participants´ point of view:
The mild processing methods were perceived as less threatening and more likely to be accepted by consumers in comparison with electromagnetic and texturing technologies. The participants recognized the ability of these technologies to provide low processed foods, while preserving their nutritional value and avoiding additives. Some stakeholders fear however that consumer acceptance of these technologies may be difficult to obtain and that the "right wording" in communication is the key for consumers' acceptance.

3.4. Advanced packaging methods

There are four promising technologies discussed under the *advanced packaging methods* that may satisfy consumer needs identified in D2.1 (Table 5).

Table 5. The advanced packaging-based food innovations against the consumer trends

Advanced packaging methods	Implemented in the market	Satisfying the following consumer needs for:				
		Health	Convenience	Pleasure	Sustainability	Authenticity
Edible coatings	In some food categories			+	+	
Biodegradable packaging film	In some food categories			+	+	
Active packaging	In some food categories		+	+		
Intelligent packaging (RFID)	In some non-food categories	+	+		+	+

Technologies such as edible coatings and biodegradable packaging film can maintain the original product attributes and have the potential for added consumer value and a price premium. *Edible coatings* imply a transparent layer applied to the food to prevent oxidising and drying out of products. This method satisfies consumer needs for better sensory attributes, food safety and sustainability (reduced packaging waste by replacing the conventional packaging) (D3.3). The costs associated with this method are related to a possible increase in price, low resistance against physical damage, sensibility to temperature and humidity, and not all coating materials are odour- and tasteless. Therefore any new application of edible coating needs to be tested on sensory acceptability before introduction.

Biodegradable packaging film implies the application of a film to food products to control moisture transfer and/or gas exchange in order to improve safety and preserve the nutritional and sensory quality, in a way that is perceived to be more environment-friendly that conventional films. The method satisfies consumers' needs for improved sensory attributes and, most important, the need for sustainability. The costs implied are: a possible increase in price and limited thermal resistance.

Active packaging systems aim to control the internal environment of the package by the addition of a reactive system inside the package or in the package wall. The method satisfies consumers' needs for improved sensory attributes, food safety and convenience by prolonging the life of the product once purchased.

Intelligent packaging is aimed to provide personally relevant information and to increase shopper efficiency. Intelligent packaging consists of indicators and sensors that provide information about the current state of a food product or about the past conditions in which

the product has been stored, that are linked to certain product characteristics. RFID (radio frequency identification) is a form of intelligent barcode or label. When connected to a network system, it offers significant information to the food manufacturer, retailer and consumer. RFID can satisfy consumer needs for convenience as (1) it facilitates the decision-making process with a wealth of additional information (on health, traceability, authenticity, sustainability) that space limitations would preclude from having printed on the label, (2) it reduces the time spent on shopping by eliminating the need for check-outs, and (3) it provides automatic reminders to the consumer when stored products are about to go out-of-date. However, RFID may be perceived as infringing individual privacy. While this is also an issue linked to loyalty card schemes, the RFID raises several privacy concerns (e.g. they may be hidden to consumer due to their size, multiple users of RFID can know how often customers go into the store, where they spend their time, what product they purchase, including purchases that the consumers prefer to keep private). Positive effects (e.g. sales) and potential for added consumer value can be obtained if this technology is used to preserve the individuals 'privacy.

Workshop participants´ point of view:

The workshop participants believed that advanced packaging methods could offer a series of benefits to consumers and their businesses. While the focus of this report is on the consumer benefit, it is relevant to mention that system innovations with respect to shelf space, logistic efficiency and inventory management were three important issues raised by the retailers and caterers with respect to the advanced packaging methods. With regard to consumer benefits, preservation of quality (experience or credence attributes - such as naturalness and nutritional properties) and sustainability through packaging was the group of benefits most positively perceived by the CFIF members. The participants believed that new packaging methods can preserve the quality (freshness) and simultaneously can extend the product shelf life; it may offer convenience and more information about the product characteristics such as healthiness and origins (traceability). And finally, the innovative packaging should involve less waste in comparison with the conventional packaging (sustainability). While there is no single formula to design an effective new packaging, some examples raised during the discussion were referring to how to attract consumer attention by developing positive emotions based on consumer senses (e.g. a temperature indicator on beer or a nice smelling packaging).

4. Conclusion

In this deliverable we try to summarize several promising food technologies that can satisfy consumer needs and have potential to drive strategic options for food innovation. The

discussion is based on insights from D2.1 and D2.2 and the participants in the 1st Collaborative Food Innovation Forum Workshop held in Paris, October 2012. We defined and assessed the selected technologies and their benefits against the emerging consumer trends identified in D2.1 and screened the selected options against the retailer´s and caterers ´opinion.

According to the participants in the workshop, predicting consumers' attitudes associated with these technologies is an important element for estimating the value of an innovation based on these technologies. The benefits discussed are expected to generate positive attitudes; however, the technology itself may raise certain concerns and perceived costs from consumer point of view. In order to be successful, the scientists and practitioners have to communicate any new technology and products based on that technology in a friendly and easy-to understand way.

5. References

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