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## **Offering Low-Cost Healthy Food: an Exploration of Food Manufacturers' and Retailers' Perspectives**

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### **Abstract**

This study investigates food manufacturers and retailers attitudes concerning offering healthy and low-cost food to consumers. Results show that the main barriers are: price perception, costs of production, easy accessibility of unhealthy food, and lack of supporting public policy. Solutions include consumers' heightened awareness and knowledge, affordability, better food chain coordination, positioning strategy, and healthy food campaigns. Bigger food manufacturers and retailers, although cautious, are more capable than smaller size enterprises in implementing relevant investment strategies. All food system actors, from agribusinesses to consumers and policymakers, need to play a role in furthering the initiative.

**Keywords:** manufacturer, retailer, healthy food, low-cost, food chain, barrier, solution, multidimensional scaling unfolding

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## Introduction

Non-communicable diseases (NCDs) are becoming the leading causes of deaths worldwide (WHO 2010b), with 36 million (63%) deaths in 2008 and an expected increasing trend up to 55 million deaths by 2030. NCD deaths are mainly caused by cardiovascular diseases (48%), cancers (21%), and chronic respiratory diseases (12%) (WHO 2010b). About 80% of coronary heart diseases and cerebrovascular diseases are due to an unhealthy diet and other behavioural risk factors (including tobacco use, physical inactivity, and alcohol abuse) (WHO 2012). The concept of malnutrition is not synonymous with under-nutrition, as the concept currently includes unhealthy eating habits. Although low fruit and vegetable intake is considered the most common and well known interpretation of an unhealthy diet, especially from the consumers' point of view, other bad food habits such as consumption of an excessive level of salt and high consumption of saturated fats and trans-fatty acids also play an important role. These bad food habits are spreading globally and affecting consumers across different socio-economic levels. Past research efforts have focused on understanding facilitators to consumers' healthy eating habits. More recent studies have focused on the private sector's role in determining the production and commercialization of healthy food and on retailers' and food manufacturers' impact on eating behaviour. Research shows that consumers' healthy food habits cannot be attributed to individual actors in the food chain, but rather to the combination of the strategies and actions of the actors in the chain. The responsibilities have been expanded and shifted. The focus is on not only the approach of single actors to healthy food, but rather how the food is 'substituted, transformed, distributed and marketed through the supply chain' (Hawkes et al. 2012), thereby involving many actors in the food chain. In other words, the food system and global supply chains are seen as not just contributors to the expansion of unhealthy food, but rather as increasingly responsible for producing and distributing a limited range of 'processed, energy- and fat-dense commodities however fortified' (Garnett 2013). The increased attention on the responsibilities of the producers and retailers in the food chain for the inadequate availability of healthy food, especially if low-cost, calls for a better understanding of food manufacturers' and retailers' experience in this respect. The objective of this paper is to explore the reasons, expectations, and critical factors along and outside the food chain that food manufacturers and retailers perceive as barriers or solutions to offering low-cost healthy food (Appendix A).

## Literature Review

The literature review focuses on the past analyses of the role that food system actors—including consumers, food manufacturers, food retailers, and policy makers have in offering low-cost healthy food.

### *Consumers and Healthy Food*

Past research strongly focused on facilitators to consumers' healthy eating habits. A positive attitude seems to be influenced by many elements, including interest in diet; perception and motivation towards healthy diets; understanding and use of nutrition labelling (Grunert and Wills 2007, Hess et al. 2012); belief in healthy food as a source for not just preventing cardiovascular diseases, but also for complete physical, mental and social well-being (Geeroms et al. 2008); high socio-economic status; accessibility to affordable healthy food (Dibsdall et al. 2003); food related

lifestyle and adequate time to cook and plan food shopping and preparation (Brunsø et al. 2004); low constraints because of household size (Burch and Lawrence 2005, Shiu et al. 2004, Holgado et al. 2000, Lawrence and Barker 2009); and good knowledge and awareness of healthy food (Dickinson-Spillman and Siegrist 2011). There are also a number of elements that prevent consumers' interest in healthy food. Price is a crucial issue, as consumers expect healthy food to be expensive or perceive the actual high price of healthy food as not attractive relative to other food (Vander Wekken et al. 2012). In addition, consumers expect healthy food not to be as enticing as 'familiar' food, which is consumed on a regular basis (Vander Wekken et al. 2012, Nestle et al. 1998, Lähteenmäki et al. 2010). In addition, consumers often do not trust the positive benefit of healthy food or have low awareness and knowledge about the nutritional value of healthy food (Ajzen 1991, Bogue et al. 2005).

### *Food Agribusiness Sector and Healthy Food*

Increased worldwide consumption of unhealthy food is influenced by the private sector's marketing strategies focused on low-cost and high availability or accessibility of unhealthy food (Pomeranz 2012, Park 2014). Throughout the world, an extensive variety of food and drink products with high fat, sugar or salt content are now widely available and strongly promoted and advertised by food manufacturers and food retailers. The following section focuses on these two food system actors and their relationship.

### *Food Industry*

A number of studies analysed which factors might influence the food industry to produce healthy food. 'Food industry needs time, resources and expertise to adapt their business model and to find new palatable products that meet healthy guidelines' (Vander Wekken 2012). Food product innovation and development and product differentiations are the result of marketing strategies (Hooker and Downs 2014), with impact on technical aspects and requirements. According to Burch and Lawrence (2005) and Harvey (2002), traditional manufacturers may take several years to market a new product line with a very slow return on investment. Furthermore, the price of food inputs can affect food manufacturers' inclination to innovate or reformulate. Less expensive inputs, even small differences, can have 'relatively large effects on aggregate production costs' (Golan et al. 2008). Innovation is also influenced by profit margin expectations along the food chain. In particular, according to Boesso et al. (2009), companies that offer health value-added products target consumers who are willing to pay more for specific health food attributes. The production and commercialization of health value-added food, especially when innovative and at a 'buyable' price, entails a financial risk as the significant 'investment required to research, develop, equip for and promote new healthy food' (Vander Wekken 2012) can negatively affect profit margin potential.

### *Food Retailers*

The retailing system also plays a progressively pivotal role in shaping the food offer available to consumers. Some consider retailers as the 'gatekeeper in the provision of nutrition to the public by virtue of their ability to control access to supermarket shelves' (Wardle and Baranovic 2009). Some interpret the gatekeeper's role for the physical accessibility of food that retailers provide. This is connected to the so-called 'food desert' concept, that is supermarkets located in poorer

neighbourhoods provide fewer healthy product choices and at higher prices (Cummins et al. 2005). Yet, limited access to healthy food has been found to be partly responsible for poor diets (Walker et al. 2010, Larson et al. 2009, Beaulac et al. 2009, Kyureghian et al. 2013). The retailing issue, especially in highly urbanised areas as in most European countries, is more than accessibility to food. The retailing system plays a leading role in terms of variety of food choices, promotion and marketing strategies, prices, market positioning, and the increasing competitiveness of their private label products. A future scenario could be that food retailers invest in convenience and sustainability and ‘deliver new healthier food’ (Bunte et al. 2011), possibly sold as private label products, and that food manufacturers remain an important ‘driver for more radical innovations in terms of food quality’ (Bunte et al. 2011). In addition to their capability of offering a range of new food products (Burch and Lawrence 2005, Kadiyali 2005), retailers have long experience in providing low-cost alternatives to consumers (Burch and Lawrence 2005).

### *Food System Relations*

Retailers have a significant influence on food manufacturers’ corporate strategies and practices, thereby creating an imbalanced relationship along the food chain. Retailers buying large quantities of product can dictate manufacturers’ decision-making processes, thus limiting their contractual power (Burch and Lawrence 2005). The issue of balance of power among actors in the chain is one of the most debated issues at the academic level (Kadiyali et al. 2000), as well as in grey literature (European Commission 2009a, 2009b). Kadiyali et al. (2000) identify the following key aspects as drivers of power shifting towards the retail sector: strong competition among manufacturers; increased concentration in the retail sector; scarcity of shelf space compared to an increased number of new products; and advanced use of information technology. Within the dynamics of the food chain, bargaining power determines the terms of economic transactions between actors and can strongly affect competition and the actors’ independency (European Commission 2009a, 2009b).

### *Public Policy and Healthy Food*

#### **Policymakers**

Public policies can and should play a role in facilitating the offer and the consumption of healthy food and minimizing unhealthy food habits. Sound public policies are necessary to improve healthy dietary habits at all food system levels. It is unclear, though, which public policies are effective ‘to leverage the supply chain towards healthier eating’ (Hawkes et al. 2012). ‘Interventions targeting the market environment, such as fiscal measures and nutrient, food, and diet standards, are rarer and generally more effective, though more intrusive’ (Brambila-Macias 2011). A public policy that promotes competition among food chain actors, for instance, is seen as a fruitful instrument. Food manufacturers may be more inclined to food reformulation in favour of healthier food proposals (Mancino et al. 2008). Lowering retailing concentration could favour affordability, accessibility, quality and choice of healthy food options to consumers (Wardle and Baranovic 2009). In addition, nutritional regulations may lead to better product quality choices by the private sector, which in turn creates a fertile competitive environment (Duvaleix-Treguer et al. 2012). Still, there is awareness that even if food industry competition can

introduce healthier products, it may not result in healthier diets (Golan and Unnevehr 2008, McCarthy et al. 2013).

## **International Organizations**

International organizations have recently taken a rather strong position in making food manufacturers and food retailers responsible for producing and selling unhealthy food. The World Health Organization (WHO) (2010a) called for ‘a need to ensure that the private sector markets its products responsibly’ through restrictions on unhealthy food marketing practices and by taxing unhealthy diets. The United Nations promotes ‘cost-effective interventions to reduce salt, sugar and saturated fats, and eliminate industrially produced trans-fats in foods, including through discouraging the production and marketing of foods that contribute to unhealthy diet’ (UN 2011). According to the WHO, the Nutrition Action plan proposal was to promote the reformulation of mainstream food products in order to reduce the amount of salt, added sugar, saturated fat, and trans fatty acids in food and to promote the availability of healthier products. This can be achieved by establishing a dialogue with food manufacturers; providing technical support, particularly to small businesses; and setting specific reformulated targets after an assessment of all potential effects (WHO 2013). The strong position of international organizations is also justified by the lack of engagement of the world’s food companies on the seriousness and urgency of the transformation called for by the WHO’s Global Strategy on Diet, Physical Activity and Health of 2004 (Lang et al. 2006).

## **Materials and Methods**

### *Design and Sample Selection*

For the research, a structured interview method was adopted to gather data and information from representatives of food manufacturers and retailers. This interview technique provided an effective and efficient method to gather qualitative information and the opinions of persons who were informed and had experience with the issues investigated. Interviews were carried out between March and July 2012. The research included 42 interviews: 24 with food manufacturers and 18 with retailers<sup>1</sup> (Table 1). In terms of food categories, the group of manufacturers covered a good variety of food sectorial specialization to avoid biases due to uncontrolled sectorial concentration. The food manufacturers interviewed already produced processed healthy food or quality food, sold under the manufacturers’ commercial brands or private labels and were active at a national level. For the retail actors, the researchers chose large retailers, discount retailers, and traditional retailers. Large retailers were selected from those with the highest annual turnover

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<sup>1</sup> In terms of size-category, for the food manufacturers the research applied the definition of Commission Recommendation 2003/361/EC as published in the Official Journal of the European Union L 124, p. 36 of 20 May 2003, Article 2 “Staff headcount and financial ceilings determining enterprise categories: 1. The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million. 2. Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million. 3. Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million”

(counting only national sales) in 2009 or 2010<sup>2</sup>. The European distribution of interviewees complies with the explorative aim of the research, provides an overview of the food chain actors' views of the heterogeneous European context<sup>3</sup>, and limits bias due to single countries' overrepresentation. It does not aim to be representative.

**Table 1.** Interviews per country and per typology of company

	<b>Finland</b>	<b>Italy</b>	<b>Lithuania</b>	<b>Serbia</b>	<b>Total</b>
<b>Food Manufacturers</b>	<b>5</b>	<b>8</b>	<b>2</b>	<b>9</b>	<b>24</b>
<b>Dairy</b>					
Small	1	1		1	3
Medium					
Big	1	1		1	3
<b>Meat/Fish</b>					
Small		1		3	4
Medium		1			1
Big	1				1
<b>Vegetable/Fruit</b>					
Small		1	1	1	3
Medium	2			1	3
Big		1			1
<b>Cereals/Bakery</b>					
Small		1	1	1	3
Medium					
Big		1		1	2
<b>Food Retailers</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>18</b>
Large	2	4	1	1	8
Discount	2			1	3
Traditional	1	1	3	2	7
<b>Total food manufacturers and food retailers</b>	<b>10</b>	<b>13</b>	<b>6</b>	<b>13</b>	<b>42</b>

### *Data Gathering*

Through a structured questionnaire, interviews aimed to gather the interviewees' opinions about offering low-cost healthy food. To ensure that the concept of healthy food was homogeneous throughout all interviews, at the beginning of the meeting the interviewers defined the concept of semi-processed or processed healthy food to be used as reference by interviewees. The

<sup>2</sup> The selection of the companies to interview and the choice of the individuals to interview within the companies were crucial steps in the research process. Companies were identified after the consultation of different sources of information: official databases (e.g. from Bureau Van Dijk), annual reports, companies' websites, personal contacts. For both food manufacturers and retailers, most interviewees belong to top management or are assistants to the board<sup>2</sup>. Interviews lasted around one hour and were carried out on the premises of the companies. Interviews were carried out using the native language common to interviewees and interviewers, with the interview questionnaire translated in advance. This approach avoided misunderstanding or lack of understanding due to limited language skills of the interviewees.

<sup>3</sup> The interviewing process was carried out as part of the 'Chance' project, a European research project funded under the 7th Framework Programme (Grant agreement no: 266331).

questionnaire included a number of close-ended statements. The statements refer to elements coming from the literature review carried out and presented in the above section. Single statements represent synthetic conceptual aggregations fed by one or more sources of literature (Appendix B). The literature review covered the food chain, food manufacturing, food retailing, food innovation, accessibility, and the consumer found relevant to offering low-cost healthy food. The main elements emerging from the literature review were then transposed into concise, clear cutting, and at the times provocative, statements representing barriers and solutions, so to stimulate a clear view of the interviewees' reasons, expectations, and critical factors to low-cost healthy food. Then, the statements were clustered into the following seven main research topics, according to their conceptual consistency in relation to the barriers and solutions to offering low-cost healthy food:

- i. *food manufacturers and retailers' relations*, in particular the interactions, dynamics, and power misbalances of food chain actors;
- ii. *price*, in particular price perception, quality perception, and affordability;
- iii. *innovation and differentiation strategies*, in particular product innovation, differentiation, roles of food chain actors, private standards, financial performance, and comparison with unhealthy food;
- iv. *food manufacturers and retailers' competitiveness strategies*, in particular positioning strategies, brand competition, and market trends;
- v. *private labels*, in particular the brand strategy of retailers;
- vi. *public policy and regulations*, in particular the awareness and knowledge of food chain actors about the issue of nutrition, the definition of healthy food, publicly funded promotions and campaigns, incentives, and labelling;
- vii. *food accessibility*, in particular access to healthy and unhealthy food.

Interviewees graded the level of importance of each statement with a Likert scale from 1 (it does not absolutely represent a barrier/solution to low-cost healthy food production/commercialization) to 7 (it is a crucial barrier/solution to low-cost healthy food production/commercialization). Interviewees graded first the entire set of barriers and then the entire set of solutions. This approach was designed to generate independent and unrelated thinking on the barriers and solutions to avoid biased feedback due to forced or involuntary consistency of the answers. For the sake of clarity and as an example of target segment, some statements stressed the attribute of low-cost of healthy food by adding at-risk-of-poverty or low-income population.

### *Data Analysis*

The objective of the data analysis was to identify the significance of the single statements for food manufacturers and retailers and to highlight whether the two typologies of food chain actors react similarly or differently to the ideal combination of a given set of barriers and solutions concerning the same topic. This methodological approach served to analyse the perception of individual respondents and to understand the systemic framework determined by the interaction of food manufacturing and retailing actors. The availability of low-cost healthy food on the market comes from decisions taken by single actors that act within a multi-actor economic frame. These data analysis objectives were achieved, first, through frequencies, and then, by applying

the multidimensional scaling unfolding (MDU) technique of analysis<sup>4</sup> (Borg and Groenen 2005). MDU, as a model for preferential choice, shows that even if different individuals might rank various objects of choice similarly, they might differ with respect to what they consider an 'ideal combination of the object's attributes' (Borg and Groenen 2005). In order to facilitate the exploration of the latent patterns underlying each topic, the results obtained were illustrated through a joint display of the respondents, barriers and solutions in the same map for each of the seven topics mentioned above. The visual analysis of the maps facilitates the comprehension/interpretation of the relations between respondents and stimuli (both barriers and solutions), according to the resulting distances and aggregations within the map (Borg and Groenen 2005). To interpret each map, it is useful to take into account that the more the stimuli (or cluster of them) are surrounded by the respondents the more highly these stimuli (or cluster of them) are being rated by the respondents. That is to say that the preference scores of different respondents become proximities between the elements of two sets of choice objects, which are barriers and solutions. Food manufacturers and retailers are represented as 'ideal points in the space of perceptual map so that the distances from each ideal point to the object points correspond to the preference scores' (Borg and Groenen 2005). In the same way, the close distance between barriers and solutions represents the perception of the effectiveness of those solutions, and combination(s) of them, to solve the barriers as perceived by the respondents in relation to an ideal situation. In carrying out the MDU analysis, the focus was also to assess whether the differences in the combination of barriers and solutions contain patterns of aggregation due to the country, size-category of the food manufacturers, or the typology of the retailers. The data analysis adopted the non-metric MDU, using the algorithm PREFSCAL available in the statistical package for the social sciences, SPSS v. 20.0 (Busing et al. 2005) (See Appendix C for further details).

## Results

The results show the outcomes from the seven topics of analysis. The focus on single issues allows an in-depth examination of each of these topics, which is then cross-analysed in the discussion section to provide the overall views of the food chain actors on low-cost healthy food production and commercialization.

### *Food Manufacturers' and Retailers' Relations*

Food manufacturers' and retailers' relations (Table 2) are not considered very important solutions for low-cost healthy food production and commercialization (mean between 3.5 and 4.5). Lack of coordination and agreement among retailers and manufacturers (BLC, mean 4.5) and the increasing power of retailers (BRP, mean 4.2) are generally perceived as barriers that moderately limit the production and commercialization of low-cost healthy food.

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<sup>4</sup> MDU is a method generally used in marketing research to allow researchers to build an image about the relationship between respondents and objects evaluated (Borg and Groenen 2005). MDU analysis can be explorative as well as confirmatory, or present a basis to identify questions to explore in subsequent analysis.

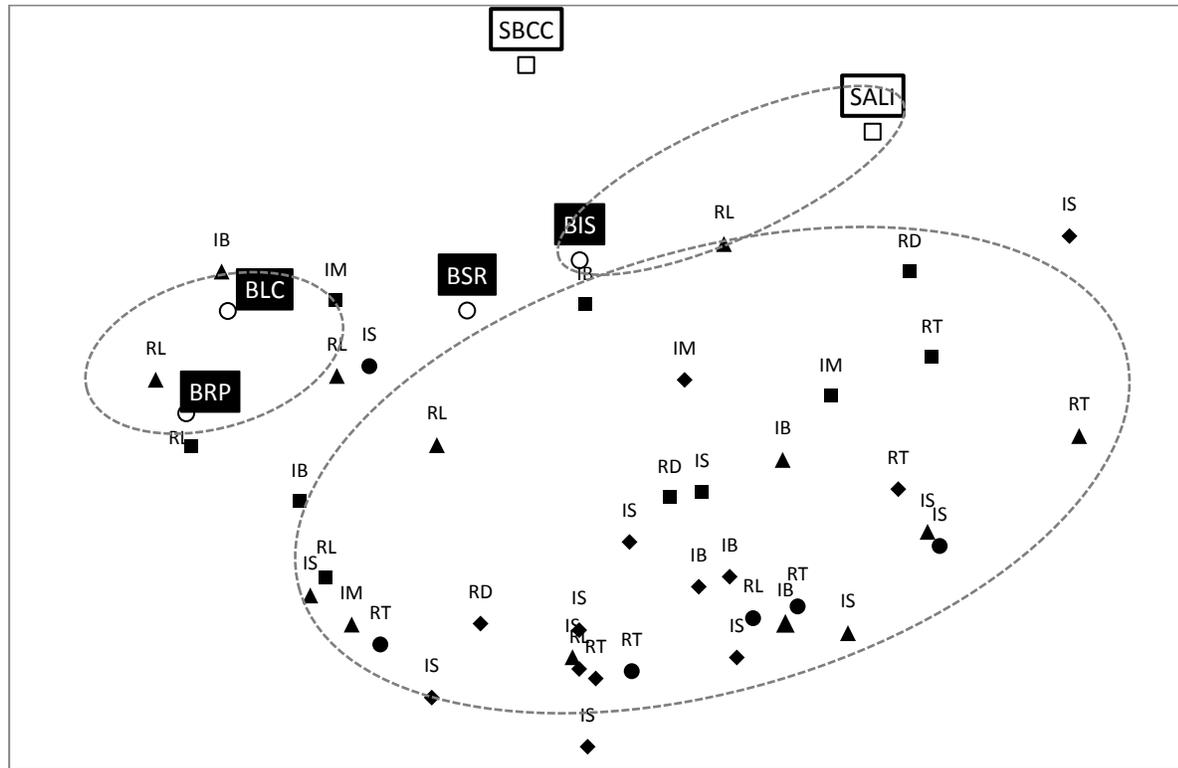
**Table 2.** Relations between food manufacturers and retailers — basic data.

<i>Barriers</i>	<b>Food Manufacturers</b>		<b>Food Retailers</b>		<b>All</b>	
	Mean	Mode	Mean	Mode	Mean	Mode
BIS. High bargaining power of suppliers of ingredients for low-cost healthy food (due to, i.e., limited number/monopoly of suppliers, scarce/no possibility to switch to other suppliers, high price of alternative suppliers)	4.0	6.0	3.5	5.0	3.8	2.0
BSR. Manufacturers favour relationships with retailers supplying the same 'old' products rather than proposing new products such as low-cost healthy food	3.3	1.0	3.8	6.0	3.5	1.0
BRP. Increasing power of retailers over what will be commercialised impedes food manufacturers interest in low-cost healthy food	4.5	7.0	3.9	2.0a	4.2	7.0
BLC. Lack of coordination and commercial agreement between manufacturers and retailers (in terms of production and commercialization) limits interest of manufacturers and retailers in low-cost healthy food	4.5	7.0	4.5	7.0	4.5	7.0
<i>Solutions</i>						
SBCC. Better coordination and commercial agreement between manufacturers and retailers (in terms of production and commercialization) increases interest of manufacturers and retailers in low-cost healthy food	5.5	6.0	5.7	7.0	5.6	6.0a
SALI. Increased availability of ingredients for low-cost healthy food	5.2	5.0a	5.2	6.0a	5.2	7.0

**Note.** Multiple modes exist. The smallest value is shown

Food manufacturers and retailers share the same perspectives on the solutions to low-cost healthy food, which focused on improving their relations (SBCC, mean 5.6) and the higher availability of low-cost ingredients (SALI, mean 5.2). Still, food manufacturers give more importance to retailers' power as a barrier to low-cost healthy food (BRP) and do not think there are limitations in proposing new products (BSR, mean 3.3, mode 1) due to stagnant chain relationships. As far as the relations between food manufacturers and retailers are concerned, the perceptions that food chain actors have about the combination of the barriers and solutions to low-cost healthy food production and commercialization are rather similar (Figure 1), regardless of the categories of respondents, nationality, or size-category of the food company. Yet interviewees' proximity to barriers suggests that respondents perceive the set of barriers as appropriate and pertinent. In addition, if barriers are also closer to each other, it suggests that interviewees think that barriers are related to each other and consistent with one another. The remoteness of food chain actors from the solutions suggests that the combination of barriers and solutions is not ideal or sufficient, that the solutions provided cannot be the *only* ones to improve low-cost healthy food production and commercialization, and that they believe that these solutions might also be accompanied by other solutions. Moreover, given that the closer solution to the barrier BIS is SALI, both manufacturers and retailers agreed that adequate availability of ingredients is a problematic issue that can be alleviated through an increase in low-cost healthy food ingredients.

The proximity of the barriers BRP and BLC shows that the increased availability of low-cost healthy food, as for many other food products, has to deal with the issue of unbalanced food chain power relationships between food manufacturers and retailers. This unbalanced relationship could however be lessened if these two food actors enter into commercial agreements to share their respective business risks.



**Legend:**

- |                                     |                                |             |
|-------------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer        | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium-sized Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer          | RT — Traditional Food Retailer | ▲ Italy     |
|                                     |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.071$ ;  $\sigma_1=0.267$ ;  $\sigma_2=0.756$

Goodness-of-fit: VAF=0.653;  $\rho_\tau=0.788$ ;  $\tau_b=0.632$

Nondegeneracy and intermixedness: Shepard's rough index= 0.707; DeSarbo intermixedness index=0.158

**Figure 1.** Map of relations between food manufacturers and retailers

*Price*

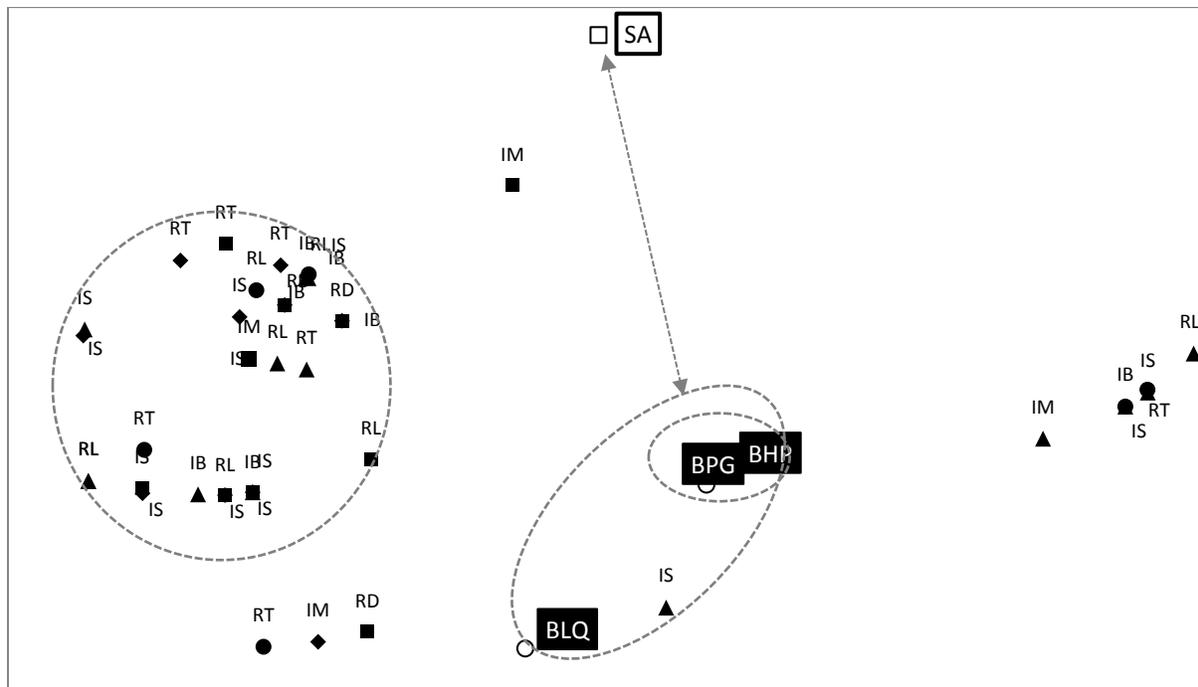
Interviewees think that the perception of at-risk-of-poverty consumers of the high price of healthy food, even if low-cost (BHP), and of the gap in price between healthy food, even if low-cost, and other familiar food (BPG) are important barriers (respectively with a mean of 5.5 and 5.3) (Table 3). Conversely, the issue of the perception of the low quality of low-cost healthy food does not represent such an important barrier (mean 4.6, mode 3). Moreover, food manufacturers and retailers are strongly concerned about the affordability of healthy food (SA, mean 6.1). The price issue generated different reactions from food manufacturers and retailers. Unlike retailers,

manufacturers seem more concerned about the perception of quality (BLQ) and less worried about high price (BHP) and gap price (BPG). This shows how food manufacturers are more concerned about production feasibility and capacity of innovation. On the other hand, retailers are more concerned about consumers' acceptability of price. Food chain actors have a similar perception regarding price issues (Figure 2). The map suggests that food manufacturers and retailers are not optimistic that low price will change the price perception of healthy food, even if the food is offered in the market at an affordable price. Low price is important and it provides an incentive for low-income consumers to buy healthy food, but it is not considered the only solution and cannot be expected to solve the problem. In addition, the actors in the food chain do not think that the quality barrier (BLQ), high price barrier (BHP), and high gap price barrier (BPG) can be solved simply by providing healthy food at an affordable price (SA). Overall respondents seem to believe that low-cost, as the only or the main product attribute at the basis of a competitive advantage strategy, is not the solution. Food affordability alone cannot overcome other misconceptions or false stereotypes that consumers might have about healthy food. Low-income and risk-of-poverty consumers are not expected to increase their consumption of healthy food, even if the healthy food is offered at a low price, thereby financially discouraging food chain actors from investing in this group of consumers and helping them to alter their food consumption habits.

**Table 3.** Price — basic data

<i>Barriers</i>	<b>Food Manufacturers</b>		<b>Food Retailers</b>		<b>All</b>	
	Mean	Mode	Mean	Mode	Mean	Mode
BHP. At-risk-of-poverty consumers' perception of high price of healthy food, even if low-cost	5.2	6.0	5.9	7.0	5.5	6.0
BPG. At-risk-of-poverty consumers' perception of high gap in price between healthy food, even though low-cost, versus their familiar food	5.0	6.0	5.6	5.0a	5.3	6.0
BLQ. At-risk-of-poverty consumers' perception of low quality of low-cost healthy food	5.0	5.0a	4.2	3.0	4.6	3.0a
<i>Solutions</i>						
SA. Affordability of healthy food would stimulate at-risk-of-poverty and low-income consumers' interest in this kind of food	6.2	7.0	5.9	7.0	6.1	7.0

**Note.** Multiple modes exist. The smallest value is shown



**Legend:**

- |                                     |                                |             |
|-------------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer        | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium-sized Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer          | RT — Traditional Food Retailer | ▲ Italy     |
|                                     |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.015$ ;  $\sigma_1=0.121$ ;  $\sigma_2=0.508$

Goodness-of-fit: VAF=0.8;  $\rho_n=0.851$ ;  $\tau_b=0.724$

Nondegeneracy and intermixedness: Shepard's rough index=0.536; DeSarbo intermixedness index=0.136

**Figure 2.** Map of price

*Innovation and Differentiation*

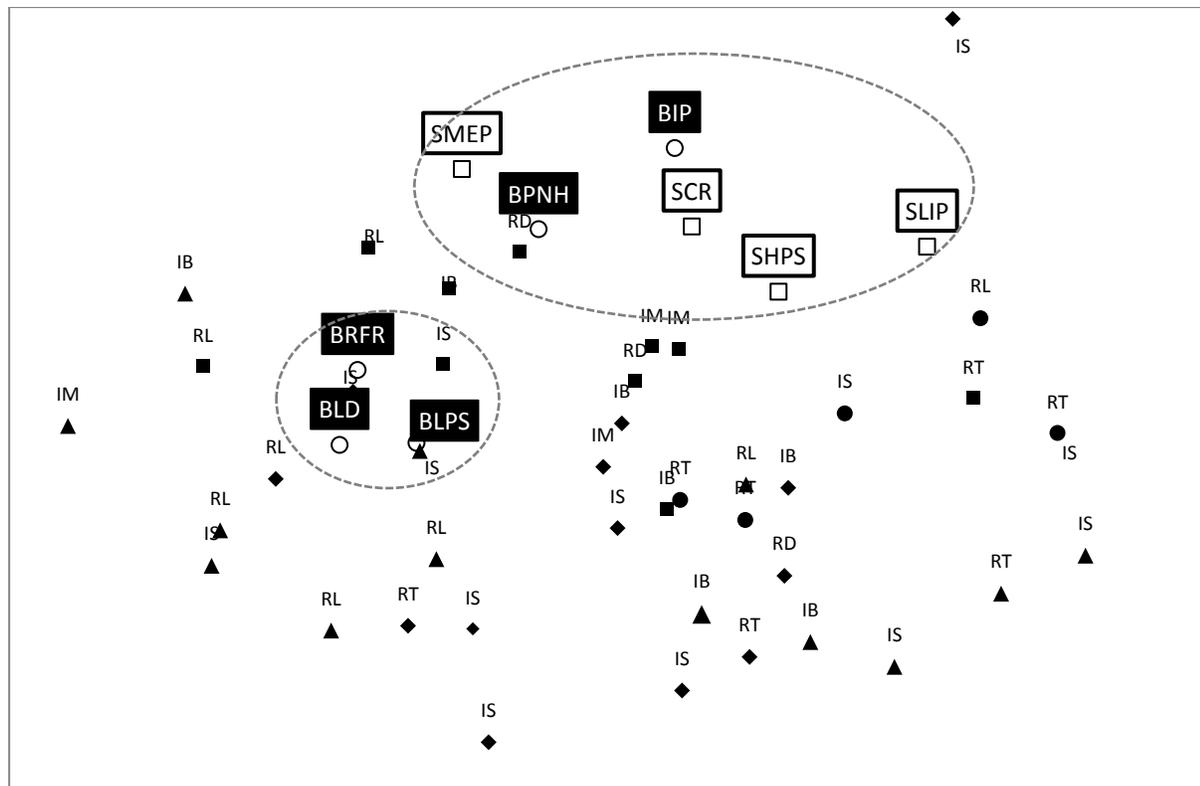
Food manufacturers and retailers perceive that barriers to innovation and differentiation have a more limited importance (mean from 4.1 to 5.5) compared to solutions (mean from 5.0 to 5.4) (Table 4). Prices of ingredients play an important role in healthy food product innovation and differentiation. Manufacturers and retailers have a similar vision of this issue, even though retailers more strongly perceive the financial risk connected with low-cost healthy food (BRFR), and food manufacturers are more concerned about the capability of differentiating (BLD) healthy food products. Food chain actors have a different perception about innovation and differentiation issues according to the size of the company or to the category of retailer (Figure 3). Unlike bigger companies, small food manufacturers and traditional retailers are less concerned by innovation and differentiation issues. This is significant and rather plausible since smaller food manufacturers or retailers have less impact on product innovation or differentiation, especially for the products under investigation. Small companies or retailers are followers rather than leaders that can influence the healthy-food industry. The map shows that bigger companies and larger retailers consider the barriers related to the level of standards (BLPS), capacity of differentiation of healthy food (BLD), and financial risk (BRFR) as more connected to their overall business strategies and operating management. In addition, the clustering of these barriers highlights the respondents' fear that low-cost healthy food cannot be adequately differentiated (BLD) due to the

attributes of price or healthiness and to the lack of private standards (BLPS), which leads to the perceived barrier connected to high financial risk (BRFR) of low-cost healthy food. The manufacturers and retailers located close to this grouping perceive that low-cost healthy food still lacks an effective food marketing positioning strategy and margin potential. The second combination of barriers and solutions shows that the barrier of high price of ingredients (BIP) can be addressed by lowering the price of ingredients (SLIP), inserting private standards of production for healthy food (SHPS), and better defining complementary roles between food manufacturers and retailers in promoting innovative products (SCR). One solution is through food chain agreements that sustain strategies of market entry protection (SMEP). This food system strategic approach could exclude competitors and allow competition with other high margin performance products (BNPH).

**Table 4.** Innovation and differentiation — basic data

	Food Manufacturers		Food Retailers		All	
	Mean	Mode	Mean	Mode	Mean	Mode
<i>Barriers</i>						
BLD. Manufacturers and retailers think that low-cost healthy food cannot be sufficiently well differentiated/does not have a valuable competitive advantage over other food	4.3	5.0	3.9	6.0	4.1	5.0
BLPS. The lack of private standards focused on healthy food production, commercialization and distribution limits consumers' interest in healthy food	4.2	1.0a	3.9	6.0	4.1	6.0
BIP. High price of ingredients to be used for low-cost healthy food	5.5	7.0	5.5	7.0	5.5	7.0
BRFR. Manufacturers and retailers believe low-cost healthy food has a high financial risk	4.1	2.0	4.4	7.0	4.2	2.0
BNPH. High margin of performance of other food in comparison to low-cost healthy food for manufacturers and retailers	4.9	6.0	4.6	6.0	4.7	6.0
<i>Solutions</i>						
SCR. Defining complementary roles in innovation processes between manufacturers and retailers for low-cost healthy food production/commercialization; for example, food manufacturers focused on quality innovation and retailers focused on understanding and flexibly adjusting to food market response to low-cost healthy food	5.2	6.0	5.3	7.0	5.2	5.0
SHPS. Commercializing food produced with private standards for healthy food can increase the intention of consumers at-risk-of-poverty to buy healthy food	4.9	4.0	5.2	4.0	5.0	4.0
SMEP. Raising manufacturers and/or retailers' standards in favour of healthy food can create barriers to marketplace entry of other manufacturers and/or retailers	5.3	7.0	5.4	7.0	5.4	7.0
SLIP. Decreased prices of ingredients for low-cost healthy food	5.2	7.0	4.8	7.0	5.0	7.0

**Note.** Multiple modes exist. The smallest value is shown



**Legend:**

- |                                     |                                |             |
|-------------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer        | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium-sized Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer          | RT — Traditional Food Retailer | ▲ Italy     |
|                                     |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.124$ ;  $\sigma_1=0.352$ ;  $\sigma_2=0.916$   
 Goodness-of-fit:  $VAF=0.546$ ;  $\rho_n=0.742$ ;  $\tau_b=0.575$   
 Nondegeneracy and intermixedness: Shepard's rough index=0.752; DeSarbo intermixedness index=0.175

**Figure 3.** Map of innovation and differentiation

*Competitiveness Strategies*

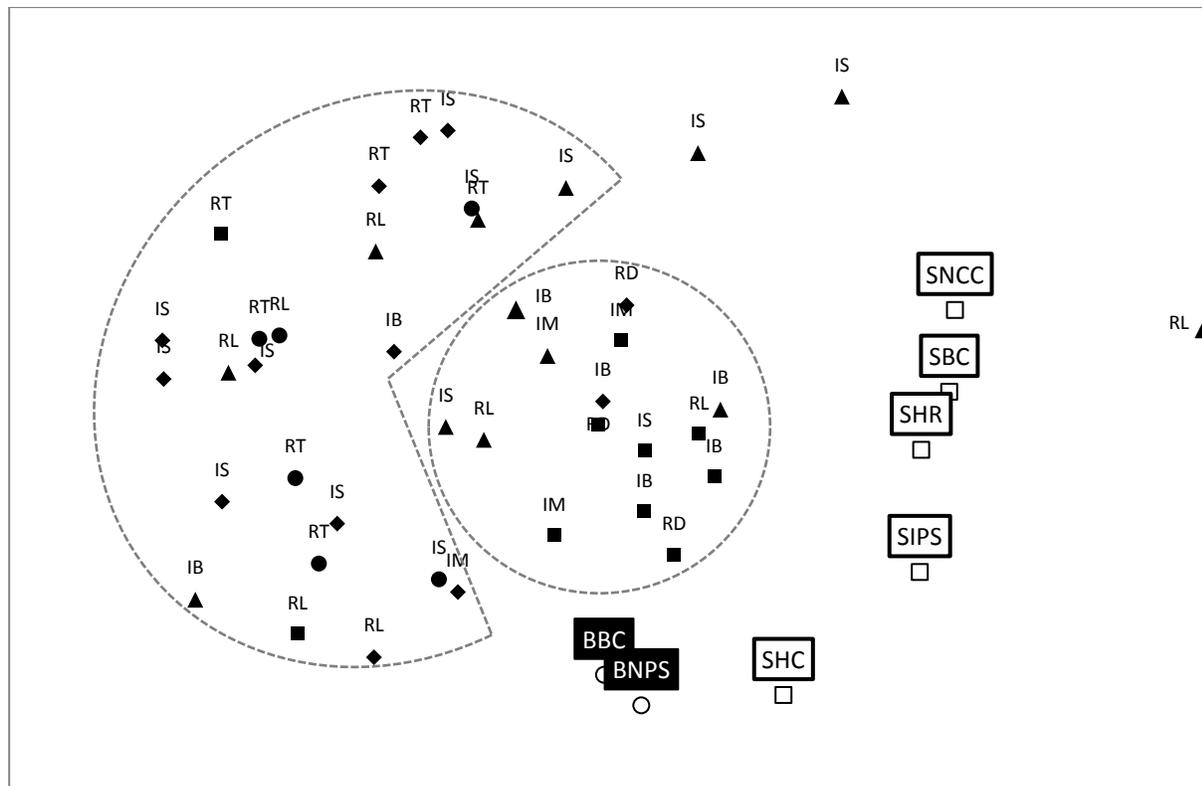
Food chain actors give importance to solutions focused on competitiveness strategies in order to increase low-cost healthy food production and commercialization (Table 5, mean between 5 and 5.5), whereas barriers receive less attention (mean between 4.6 and 4.9). The perceptions of food manufacturers and retailers differ significantly when it concerns brand competition (BBC and SBC). Retailers give more importance than food manufacturers to the strategies of healthy brand competition. In terms of a one barrier (BBC), retailers believe more strongly than food manufacturers that the competition is not sufficiently focusing on healthy food. As solutions (SBC), in the retailers' view, investment in increasing brand reputation as a healthy-food provider could lead to the production and commercialization of healthier food. This is also in line with stronger attention and investments that retailers are putting into developing their own brands, in competition with other commercial brands. Food manufacturers have competitiveness strategies for managing healthy food (Figure 4) that differ according to the size of the company. Big and medium-sized food manufacturing companies consider producing and marketing low-cost healthy

food a part of their overall competitiveness strategies and are therefore more strongly influenced by the combination of barriers and solutions presented. On the other hand, small companies perceive low-cost healthy food as worthy of attention, but these smaller companies do not design business strategies to focus on providing low-cost healthy food. According to the map, big companies believe that a better positioning strategy (SIPS) and more brand competition (SBC) of food system actors could address the low level of interest of food manufacturers and retailers in healthy food (BNPS, BBC), which could lead to an increase in low-cost healthy food production. Making healthy food recipes (SHR) and cooking classes easily accessible (SNCC) can contribute to an increased positioning strategy focused on low-cost healthy food and as instruments for stimulating the competition between food manufacturers and retailers, thereby increasing the competitiveness of food chain actors. Large food manufacturers and retailers have a vested interest in supporting public campaigns (SHC) that educate the population about consuming healthier food as part of their competitiveness strategy oriented more on healthy food.

**Table 5.** Competitiveness strategies — basic data

	Food Manufacturers		Food Retailers		All	
	Mean	Mode	Mean	Mode	Mean	Mode
<i>Barriers</i>						
BNPS. Positioning strategy of manufacturers and retailers not sufficiently focused on low-cost healthy food	4.8	6.0	5.0	7.0	4.9	7.0
BBC. Insufficient competition between manufacturers and retailers over healthy brand reputation/positioning	4.2	5.0	5.1	7.0	4.6	5.0
<i>Solutions</i>						
SIPS. Food manufacturers' or retailers' increased positioning strategy focused on low-cost healthy food	5.5	7.0	5.4	7.0	5.5	7.0
SBC. Food manufacturers and retailers competition over healthy brand reputation/positioning favours propensity to healthier food (re)formulation	4.7	5.0a	5.6	7.0	5.1	7.0
SHC. Introducing or strengthening the supporting role of retailers and/or food manufacturers in favour of public health campaign and healthy food consumption	5.4	7.0	5.7	7.0	5.5	7.0
SHR. Food manufacturers' or retailers' provide consumers recipes for low-cost healthy food/meals	4.8	7.0	5.3	5.0a	5.0	7.0
SNCC. Conduct nutrition education classes and cooking classes, including shopping and food budgeting guidance, at the retailers' store targeted at risk-of-poverty/low-income population	5.0	7.0	5.4	7.0	5.2	7.0

**Note.** Multiple modes exist. The smallest value is shown



**Legend:**

- |                                     |                                |             |
|-------------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer        | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium-sized Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer          | RT — Traditional Food Retailer | ▲ Italy     |
|                                     |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.061$ ;  $\sigma_1=0.248$ ;  $\sigma_2=0.788$   
 Goodness-of-fit: VAF=0.606;  $\rho_n=0.767$ ;  $\tau_b=0.612$   
 Nondegeneracy and intermixedness: Shepard's rough index=0.686; DeSarbo intermixedness index=0.377

**Figure 4.** Map of competitiveness strategies

*Private Label*

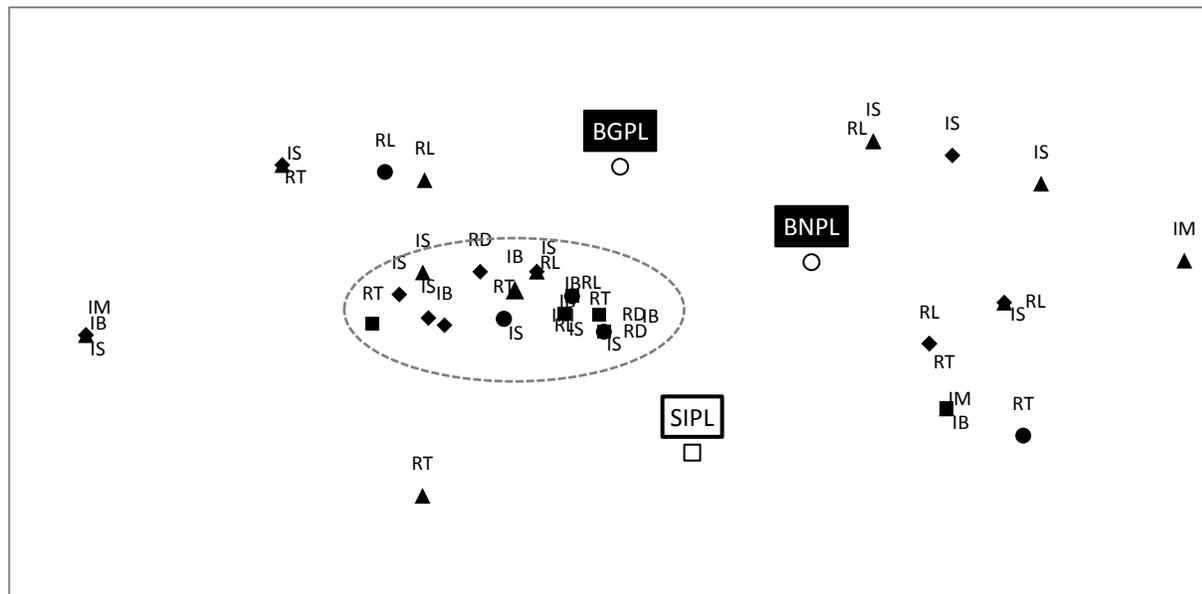
Food chain interviewees agree that the current growth of private label sales (BGPL) and retailers' limited interest in private label lines as brands for low-cost healthy food (BNPL) are relevant, but not very important barriers to low-cost healthy food (Table 6, respective means are 4.5 and 4). There is stronger agreement over the suggestion of using a private label as a carrier brand for low-cost healthy food (SIPL, mean 5.4). Still, the differences among food manufacturers' and retailers' opinions are noteworthy. Food manufacturers seem to give a prominent role to private labels. Food manufacturers (mean 4.9) believe more strongly than retailers (mean 4.1) that the ever-growing phenomenon of private label versus commercial brands is limiting food manufacturers' capacity for investment in low-cost healthy food (BGPL). Again, food manufacturers' (mean 5.5) trust in private labels as a way to enter the low-cost healthy food market (SIPL) is higher than retailers (mean 5.2). The respondents' position on the map (Figure 5) suggests that many respondents perceive that retailers' current private label management strategy (BGPL and BNPL) is limiting the possibility of offering low-cost healthy food. Reacting by increasing retailers' interest in marketing low-cost healthy food with a private label is considered a constructive strategy (SIPL). The central cluster of respondents includes a mix of

food manufacturers and retailers with most of the big companies. These big companies' consistent position demonstrates the rather cohesive thinking of the group. On the contrary, smaller companies are both inserted in the central group and spread around the map, thereby showing quite variegated opinions on the issue. Moreover, retailers' position around the map shows that the issue of private labels in relation to low-cost healthy food induces dissimilar opinions among retailers. This is the likely consequence of the manifold strategic approaches that private label brands have in food commercialization management and product innovation.

**Table 6.** Private label — basic data

<i>Barriers</i>	<b>Food Manufacturers</b>		<b>Food Retailers</b>		<b>All</b>	
	Mean	Mode	Mean	Mode	Mean	Mode
BGPL. Consumers' increasing interest in private label vs. commercial brands limits food manufacturers' intentions to invest in low-cost healthy food	4.9	5.0	4.1	1.0a	4.5	5.0
BNPL. Retailers' very limited interest in private label lines for low-cost healthy food	4.0	3.0	3.8	1.0	4.0	3.0
<i>Solutions</i>						
SIPL. Inserting low-cost healthy food in the market within a private label	5.5	7.0	5.2	5.0	5.4	5.0

**Note.** Multiple modes exist. The smallest value is shown



**Legend:**

- IS — Small Food Manufacturer
- IM — Medium-sized Food Manufacturer
- IB — Big Food Manufacturer
- RL — Large Food Retailer
- RD — Discount Food Retailer
- RT — Traditional Food Retailer
- Lithuania
- Finland
- ▲ Italy
- ◆ Serbia

Badness-of-fit:  $\sigma_n=0.009$ ;  $\sigma_1=0.093$ ;  $\sigma_2=0.26$

Goodness-of-fit: VAF=0.938;  $\rho_n=0.933$ ;  $\tau_b=0.826$

Nondegeneracy and intermixedness: Shepard's rough index=0.681; DeSarbo intermixedness index=0.022

**Figure 5.** Map on private label

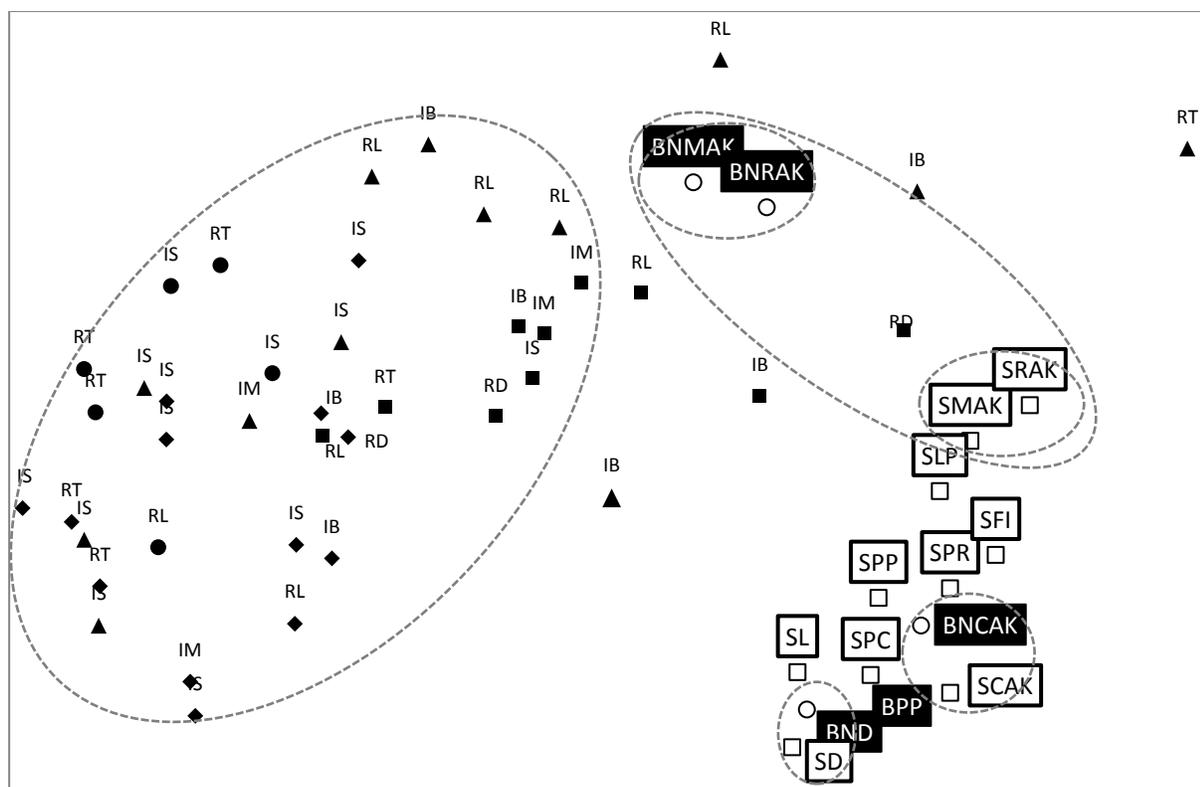
*Public Policy and Regulations*

Food chain actors perceive the lack of adequate public policy in support of healthy food (BPP, mean 6.1) and the inadequate comprehension of consumers about healthy food (BNCAK, mean 5.6) (Table 7) as significant barriers. This issue should be addressed by improving consumer awareness and knowledge about nutritional issues (SCAK, mean 6.3). The lack of an official definition of what healthy food is (BND, mean 5.6) is also a barrier. This should be addressed with an official agreement on the definition of *healthy food* (SD, mean 5.8).

**Table 7.** Public policy and regulations — basic data

<i>Barriers</i>	<b>Food Manufacturers</b>		<b>Food Retailers</b>		<b>All</b>	
	Mean	Mode	Mean	Mode	Mean	Mode
BND. Lack of an official definition of healthy food	5.5	7.0	5.7	7.0	5.6	7.0
BNMAK. Inadequate awareness and knowledge of manufacturers about nutritional issues	4.3	7.0	3.6	1.0	4.0	1.0a
BNRAK. Inadequate awareness and knowledge of retailers about nutritional issues	4.5	3.0	3.7	3.0	4.2	3.0
BNCAK. Inadequate awareness and knowledge of at-risk-of-poverty consumers about nutritional issues	5.5	7.0	5.8	7.0	5.6	7.0
BPP. Lack of adequate public policy intervention concerning the promotion of healthy food for at-risk-of-poverty and low-income people	6.0	7.0	6.2	7.0	6.1	7.0
<i>Solutions</i>						
SMAK. Improving awareness and knowledge of manufacturers about nutritional issues	5.2	7.0	5.8	7.0	5.5	7.0
SRAK. Improving awareness and knowledge of retailers about nutritional issues	5.7	7.0	5.4	7.0	5.6	7.0
SCAK. Improving awareness and knowledge of consumers about nutritional issues, with specific focus on those at risk of poverty	6.1	7.0	6.5	7.0	6.3	7.0
SD. Agreement about an official definition of healthy food	5.8	7.0	5.8	7.0	5.8	7.0
SPP. Promotion of low-cost healthy food recipes (for example, low budget, limited available time) by web, funded/promoted through national schemes	5.2	5.0a	5.7	7.0	5.4	7.0
SPC. Providing publicly funded communication campaign about low-cost healthy food	5.6	5.0	6.0	7.0	5.8	7.0
SPR. Public policy and public regulations can contribute to guaranteeing low-cost healthy food production, commercialization and distribution	5.6	7.0	5.9	7.0	5.7	7.0
SFI. Identifying financial incentives and disincentives to leveraging the supply chain in the direction of low-cost healthy food	6.1	6.0a	5.3	7.0	5.8	7.0
SLP. Introduction of policies affecting commodity (ingredient) prices could result in product reformulation to less expensive healthier inputs	5.4	7.0	4.9	7.0	5.2	7.0
SL. Introduction of a regulation in favour of labelling healthy food	5.0	6.0	5.7	7.0	5.3	7.0

According to respondents, other important solutions may include publicly funded educational campaigns about healthy food consumption (SPC, mean 5.8) and financial incentives and disincentives in developing and sustaining a more healthy food-oriented supply chain (SFI, mean 5.8). Food manufacturers and retailers showed different levels of interest in a small number of propositions. As far as barriers are concerned, food manufacturers think that both their own (BNMAK, mean 4.3) and retailers' (BNRAK, mean 4.5) awareness and knowledge represent a relevant barrier to producing and selling healthy food. Food manufacturers believe more strongly than retailers in the support that financial incentives (SFI, mean 6.1) could encourage all food chain actors to increase their investment in producing low-cost healthy food. Finally, retailers seem more strongly interested than food manufacturers in appropriate healthy food labelling (SL, mean 5.7). Respondents share similar opinions regarding the combination of barriers and solutions concerning public policy and regulations (Figure 6).



**Legend:**

- |                                     |                                |             |
|-------------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer        | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium-sized Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer          | RT — Traditional Food Retailer | ▲ Italy     |
|                                     |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.042$ ;  $\sigma_1=0.206$ ;  $\sigma_2=0.795$

Goodness-of-fit: VAF=0.62;  $\rho_n=0.768$ ;  $\tau_b=0.625$

Nondegeneracy and intermixedness: Shepard's rough index=0.578; DeSarbo intermixedness index=0.925

**Figure 6.** Map on public policy and regulations

The barriers that respondents admit as relevant and related are the lack of adequate manufacturers' (BNMAK) and retailers' (BNRAK) awareness and knowledge about nutrition,

which should be faced by directly targeting them (SMAK and SRAK). Similarly, food chain actors believe that the inadequate awareness and knowledge about nutritional issues of low-income consumers (BNCAK) can be addressed with the corresponding solution (SCAK), but in coordination with other publicly promoted actions. Respondents have a similar judgment about another pair of statements: lack of definition (BND) and the need for a uniformed definition of healthy food (SD). This means that interviewees believe that the barrier can be addressed by acting directly in favour of targeting that specific problem. Finally, respondents believe that these barriers can be addressed through public support for healthy food (SPP), campaigns (SPC), financing (SFI), and regulation (SPR, SD, SL). The map also shows that interviewees believe that only coordinated actions can increase healthy food production and commercialization.

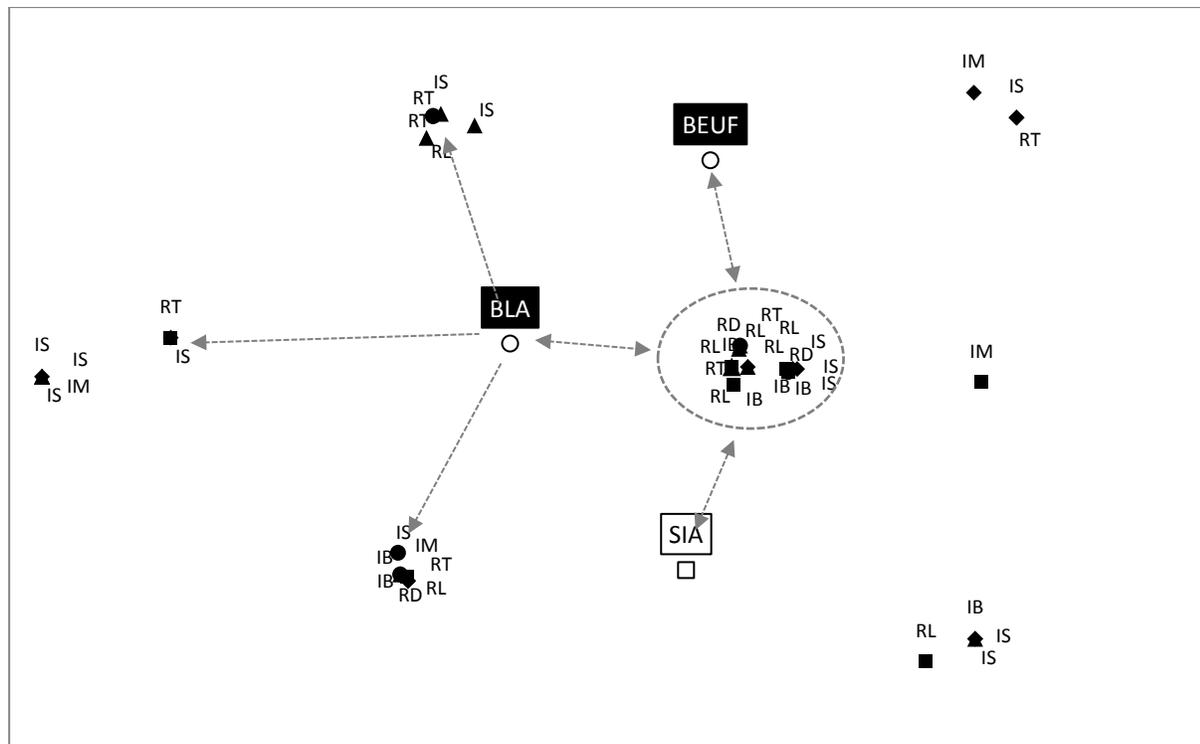
*Food Accessibility*

Lack of access, even though appropriate, is not an important barrier to healthy food consumption and commercialization (BLA, mean 4.2), as far as food chain actors are concerned (Table 8). In fact, consumers’ easy access to unhealthy food is believed to be a more important barrier (BEUF, mean 5.2). Interviewees believe that if consumers, even those at a low-income level, have easier access to low-cost healthy food, they will increase their consumption of more nutritious food, albeit only moderately (SIA, mean 5.4). Food manufacturers and retailers have different views on these issues. Food manufacturers generally give more importance to both barriers and solutions, especially if the barrier represents the lack of access to healthy food (BLA, mean 5 of food manufacturers versus 3.2 of retailers). The issue of food accessibility is rather controversial, as shown by the many micro-clusters of respondents (Figure 7). Still there is relatively strong agreement among the majority of respondents over the positive contribution that the improvement of at-risk-of-poverty consumers’ access to low-cost healthy food (SIA) can have in lowering the barrier of the lack of access to low-cost healthy food (BLA).

**Table 8.** Food accessibility — basic data

	<b>Food Manufacturers</b>		<b>Food Retailers</b>		<b>All</b>		
	Mean	Mode	Mean	Mode	Mean	Mode	
<i>Barriers</i>							
BLA. At-risk-of-poverty consumers’ lack of access to low-cost healthy food	5.0	7.0	3.2	1.0	4.2	7.0	
BEUF. Consumers’ easy access to food that is not healthy	5.5	7.0	4.8	6.0	5.2	7.0	
<i>Solutions</i>							
SIA. Improving access of consumers at risk of poverty to low-cost healthy food (for example, increasing commercialization and distribution in areas with risk of poverty and making low-cost healthy food easily reachable by those at risk of poverty)	5.7	7.0	4.9	6.0a	5.4	7.0	

**Note.** Multiple modes exist. The smallest value is shown



**Legend:**

- |                               |                                |             |
|-------------------------------|--------------------------------|-------------|
| IS — Small Food Manufacturer  | RL — Large Food Retailer       | ● Lithuania |
| IM — Medium Food Manufacturer | RD — Discount Food Retailer    | ■ Finland   |
| IB — Big Food Manufacturer    | RT — Traditional Food Retailer | ▲ Italy     |
|                               |                                | ◆ Serbia    |

Badness-of-fit:  $\sigma_n=0.012$ ;  $\sigma_1=0.107$ ;  $\sigma_2=0.274$   
 Goodness-of-fit: VAF=0.931;  $\rho_n=0.895$ ;  $\tau_b=0.757$   
 Nondegeneracy and intermixedness: Shepard’s rough index=0.567; DeSarbo intermixedness index=0.037

**Figure 7.** Map on food accessibility

*Summary of Results*

Food manufacturers and retailers can prioritise the most prominent barriers to providing consumers with healthy food, but they have limited capability to prioritise one solution. The main perceived barriers concern the price, easy accessibility to unhealthy food, and lack of adequate public policy to support the provision of low-cost healthy food. The most relevant solution to increasing healthy food availability is to heighten consumers’ awareness and knowledge about healthy food. Of course, other equally important solutions such as the affordability of healthy food, better coordination and commercial agreement between the manufacturers and retailers, support for a healthy food campaign, and a shift in retailers’ and manufacturers’ business strategy to focus on healthy food will also play a defining role in increasing healthy food consumption. These responses show that food chain actors acknowledge that there exists a market for healthy food, but that food chain actors are not ready to fully engage in this market, because of a number of perceived critical factors that concern both the private and the public dimensions. Not only food manufacturers and retailers could have a role in increasing low-cost healthy food offer, but also all other food system actors, including consumers and policy makers. All food chain actors

regardless of size or category demonstrated the lack of a concrete investment strategy for these products. Small and medium-sized enterprises provided more diverse and uncertain feedback, and big food manufacturers and large retailers have more experience and provided more informed feedback as far as innovation, differentiation and competitiveness strategies are concerned. Yet they have not yet taken a prominent or initiating role in manufacturing and commercializing low-cost healthy food.

## Discussion

The reasons, expectations, and critical factors expressed by food chain actors about low-cost healthy food production and commercialization demonstrate that the issue is multifaceted and should be addressed on many different fronts. First, low-cost healthy food is a consumer good that, if placed within the product life cycle, seems to be in its *introduction* stage. The exploratory survey shows that both food manufacturers and retailers are interested in investing in producing healthy food, but they are cautious. This is even more evident if healthy food is to be sold at a low price. The newness of the low-cost healthy food market prevents food chain actors from investing resources to develop a business strategy to bring healthy food to the masses. The innovativeness of the market is spread throughout various countries and, though to a lesser extent, is also related to the size-category of the companies.

The food chain actors' cautious approach to the newness of low-cost healthy food market suggests that public sector initiatives are necessary to reach the *growth* stage. Second, low-cost healthy food is a challenge in terms of price to market, price adequate to cover the costs, and a source of financial risk. Food chain actors are sceptical that healthy food affordability is a real barrier to its consumption. Food manufacturers and retailers believe that price is a key attribute to healthy food, but they are aware that ensuring a low price is not a sufficient solution, even for low-income people. In their view, the importance of the price of healthy food is often overestimated, and the solution should be found in a well-balanced basket of product attributes. Third, food chain actors are sceptical about consumers' appreciation of healthy food. In their view, the image of healthy food should improve and become more attractive and, especially, competitive if compared with the image of other familiar or unhealthy food. The concept of *healthy* should get closer to *tasty*. Food manufacturers and retailers fear that the capacity to differentiate healthy food, compared with other food, is too low and not sufficiently competitive. Therefore, food chain actors should strive at improving consumers' understanding and appreciation of healthy food, which will lead to heightened acceptability of healthy food. Finally, food chain actors call for concrete public policies that support low-cost healthy food production and commercialization. Although self-serving, their views are worth consideration because of their experience and expertise. In line with food chain actors' expectations, public actors could set financial incentives and targeted policies to sustain, initiate and boost the evolving healthy food market and to define public policies better responsive to the alarming health phenomenon. This can eventually lead to fewer illnesses or deaths attributable to NCDs, thus reducing the strain on the economy and healthcare system.

## Conclusion

The plausible disenchantment of food chain actors in the development and increase in the consumption of low-cost healthy food discloses the distance between current food manufacturers' and retailers' corporate strategy and alarming social and health trends. Yet, in order to match the legitimate economic interests of the private sector with the need to increase the supply of low-cost healthy food, the reasons, expectations and critical factors expressed by the food chain actors must be addressed through targeted and strengthened private and public cooperation.

## Acknowledgements

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## References

- Ajzen, I. 1991. The Theory of Planned Behavior. *Organizational Behaviour and Human Decision Processes* 50: 179-211.
- Beaulac, J., E. Kristjansson and S. Cummins. 2009. A systematic review of food deserts, 1966–2007. *Preventing Chronic Disease* 6 (3, A105): 1-10.
- Boesso, G., N.S. Davcik and F. Favotto. 2009. "Health-enhancing" Products in the Italian Food Manufacturers: Multinationals and SMEs Competing on Yogurt. *AgBioForum* 12 (2): 232–243.
- Bogue, J., T. Coleman and D. Sorenson. 2005. Determinants of consumers' dietary behaviour for health-enhancing foods. *British Food Journal* 107 (1): 4–16.
- Borg, I. and P. Groenen. 2005. *Modern Multidimensional Scaling: theory and applications* (2nd ed.). New York: Springer-Verlag.
- Brambila-Macias, J. 2011. Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising. *Food Nutrition Bulletin* 32 (4): 365–375.
- Brunso, K., J. Scholderer and K.G. Grunert. 2004. Testing relationships between values and food-related lifestyle: results from two European countries. *Appetite* 43: 195–205.
- Bunte, F.H.J., M.A. Van Galen, M.A. de Winter, P. Dobson, F. Bergès-Sennou, S. Monier-Dilhan, A. Juhász, D. Moro, P. Sckokai, C. Soregaroli, B.M.J. van der Meulen and A. Szajkowska. 2011. *The impact of private labels on the competitiveness of the European food supply chain*. Luxembourg: Publications Office of the European Union.

- Burch, D. and G. Lawrence. 2005. Supermarket own brands, supply chains and the transformation of the agri-food system. *International Journal of Sociology of Agriculture and Food* 13 (1): 9–18.
- Busing, F.M.T.A, P.J.K. Groenen and W.J. Heiser. 2005. Avoiding degeneracy in multidimensional unfolding by penalizing on the coefficient of variation. *Psychometrika* 70, 1, 71–98.
- Caraher, M. and J. Coveney. 2004. Public health nutrition and food policy. *Public Health Nutrition* 7 (5): 591–8.
- Campos, S., J. Doxey and D. Hammond. 2011. Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutrition* 14 (8): 1496–1506.
- European Commission. 2009a. Communication (2009) 591. *A better functioning food supply chain in Europe*. Brussels.
- European Commission. 2009b. *Competition in the food supply chain*. Accompanying document to the Communication (2009) 591. A better functioning food supply chain in Europe. Brussels.
- Cummins, S., M. Petticrew, L. Sparks and A. Findlay. 2005. Large scale food retail interventions and diet. *BMJ* 330: 683–684.
- Dibsdall, L.A., N. Lambert, R.F. Bobbin and L.J. Frewer. 2003. Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. *Public Health Nutrition* 6 (2): 159–68.
- Dickson-Spillmann, M. and M. Siegrist. 2011. Consumers' knowledge of healthy diets and its correlation with dietary behaviour. *Journal of Human Nutrition and Dietetics: The official journal of the British Dietetic Association* 24: 54–60.
- Duvaléix-Treguer, S., A. Hammoudi, L. Rouached and L.G. Soler. 2012. Firms' responses to nutritional policies. *European Review of Agricultural Economics* 39 (5): 843–877.
- Food Marketing Institute. 2012. *Survey Report: Retailer Contributions to Health and Wellness*.
- Garnett, T. 2013. Food sustainability: problems, perspectives and solutions. *The Proceedings of the Nutrition Society* 72: 29–39.
- Geeroms, N., W. Verbeke and P. Van Kenhove. 2008. Consumers' health-related motive orientations and ready meal consumption behaviour. *Appetite* 51: 704–12.
- Gloria, C.T. and M.A. Steinhardt. 2010. Texas nutrition environment assessment of retail food stores (TxNEA-S): development and evaluation. *Public Health Nutrition* 13 (11): 1764–1772.

- Golan, E. and L. Unnevehr. 2008. Food product composition, consumer health, and public policy: Introduction and overview of special section. *Food Policy* 33: 465–469.
- Grunert, K.G. and J.M. Wills. 2007. A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health* 15: 385–399.
- Hartmann, C., S. Dohle and M. Siegrist. 2013. Importance of cooking skills for balanced food choices. *Appetite* 65: 125–31.
- Harvey, M., S. Quilley and H. Beynon. 2002. *Exploring the Tomato: Transformations of Nature, Society and Economy*. Cheltenham, U.K.: Edward Elgar.
- Hawkes, C., S. Friel, T. Lobstein and T. Lang. 2012. Linking agricultural policies with obesity and noncommunicable diseases: A new perspective for a globalising world. *Food Policy* 37: 343–353.
- Hess, R., V.H.M. Visschers and M. Siegrist. 2012. The role of health-related, motivational and sociodemographic aspects in predicting food label use: a comprehensive study. *Public Health Nutrition* 15 (3): 407–14.
- Holgado, B. 2000. Barriers and benefits of a healthy diet in Spain: comparison with other European member states. *European Journal of Clinical Nutrition* 54: 453–459.
- Hooker, N.H. and S. Downs. 2014. Trans-border reformulation: US and Canadian experiences with *trans* fat. *International Food and Agribusiness Management Review* 17 Special issue A: 131-146.
- Inglis, V., K. Ball and D. Crawford. 2005. Why do women of low socioeconomic status have poorer dietary behaviours than women of higher socioeconomic status? A qualitative exploration. *Appetite* 45: 334–43.
- Kadiyali, V., P. Chintagunta and N. Vilcassim. 2000. Manufacturer-Retailer Channel Interactions and Implications for Channel Power: An Empirical Investigation of Pricing in a Local Market. *Marketing Science* 19 (2): 127–148.
- Kyureghian, G., R.M. Nayga and S. Bhattacharya. 2013. The Effect of Food Store Access and Income on Household Purchases of Fruits and Vegetables: A Mixed Effects Analysis. *Applied Economic Perspectives and Policy* 35 (1): 69–88.
- Lähteenmäki, L., P. Lampila, K.G. Grunert, Y. Boztug, Ø. Ueland, A. Åström and E. Martinsdóttir. 2010. Impact of health-related claims on the perception of other product attributes. *Food Policy* 35: 230–239.

- Lang, T., G. Rainer and E. Kaelin. 2006. *The food industry, diet, physical activity and health: a review of reported commitments and practice of 25 of the world's largest food companies*. London: City University, 2006. [http://www.city.ac.uk/\\_\\_data/assets/pdf\\_file/0004/167521/City-Univ-Food-Co-Health-Monitoring-04-04-06.pdf](http://www.city.ac.uk/__data/assets/pdf_file/0004/167521/City-Univ-Food-Co-Health-Monitoring-04-04-06.pdf) [accessed Dec 1, 2013].
- Lappalainen, R., J. Kearney and M. Gibney. 1998. A pan EU survey of consumer attitudes to food, nutrition and health: an overview. *Food Quality and Preference* 9 (6): 467–478.
- Larson, N.I., M.T. Story and M.C. Nelson. 2009. Neighborhood environments: disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine* 36 (1): 74–81.
- Lawrence, W. and M. Barker. 2009. A review of factors affecting the food choices of disadvantaged women. *The Proceedings of the Nutrition Society* 68: 189–94.
- Mancino, L., F. Kuchler and E. Leibtag. 2008. Getting consumers to eat more whole-grains: The role of policy, information, and food manufacturers. *Food Policy* 33: 489–496.
- McCarthy, M., E. Cluzel, K. Dressel and R. Newton. 2013. Food and health research in Europe: Structures, gaps and futures. *Food Policy* 39: 64–71.
- Nestle, M., R. Wing, L. Birch, L. DiSogra, A. Drewnowski, S. Middleton, M. Sigman-Grant, J. Sobal, M. Winston and C. Economos. 1998. Behavioral and social influences on food choice. *Nutrition reviews* 56 (5) S50–S74.
- Park, T. 2014. Food demand, diet and Health – the role played by managers of agribusinesses. *International Food and Agribusiness Management Review* 17 Special Issue A: 1-5.
- Pomeranz, J.L. 2012. Advanced policy options to regulate sugar-sweetened beverages to support public health. *Journal of Public Health Policy* 33 (1): 75–88.
- Shiu, E.C.C., J.A. Dawson and D.W. Marshall. 2004. Segmenting the convenience and health trends in the British food market. *British Food Journal* 106 (2): 106–127.
- United Nations. 2011. *Draft resolution submitted by the President of the General Assembly - Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases*. New York: United Nations.
- Vander Wekken, S., S. Sørensen, J. Meldrum and P.J. Naylor. 2012. Exploring manufacturers perspectives on implementation of a provincial policy for food and beverage sales in publicly funded recreation facilities. *Health Policy* 104: 279–287.
- Walker, R.E., C.R. Keane and J.G. Burke. 2010. Disparities and access to healthy food in the United States: A review of food deserts literature. *Health & Place* 16: 876–884.
- Wardle, J. and M. Baranovic. 2009. Is lack of retail competition in the grocery sector a public health issue? *Australian and New Zealand Journal of Public Health* 33: 477–481.

WHO. 2010a. *Set of recommendations on the marketing of food and non-alcoholic beverages to children*. Geneva: World Health Organization.

WHO. 2010b. *Global status report on noncommunicable diseases*. Geneva: World Health Organization.

WHO. 2012. *World Health Statistics - Part II Highlighted topics*. Geneva: World Health Organization.

WHO. 2013. *Mapping salt reduction initiatives in the WHO European Region*. Geneva: World Health Organization.

Worsley, A., W. Wang, S. Ismail and S. Ridley. 2014. Consumers' interest in learning about cooking: the influence of age, gender and education. *International Journal of Consumer Studies* 38 (3): 258–264.

## Appendix A

### *Definition of semi-processed or processed healthy food provided to interviewees*

A food with a *good nutrient profile*, that is a food not containing a high amount of nutrients (sodium, total fat, saturated fat, and sucrose), the high intake of which could be responsible for an increase in the risk of disease; or a food with *good nutritional density*, that is a food with a high content of fiber, micronutrients (vitamins and minerals) and bioactive compounds (polyphenols, phytosterols, carotenoids [such as lycopene], tocopherols, probiotics, etc.). Interviewees can also refer to a food *with a nutritional claim*, that is any claim that states, suggests or implies that a food has particular beneficial nutritional properties due to the nutrients or other substances it (i) contains, (ii) contains in reduced or increased proportions, or (iii) does not contain. Interviews did not refer to food with a health claim or functional food. Examples of good nutrient profile food or food with a nutritional claim given to interviewees: food that does not contain, or contains in reduced proportions, any of the following: sodium, total fat, saturated fat, sucrose; and food that contains, or contains increased proportions of, any of the following: fiber, micronutrients (vitamins and minerals), and bioactive compounds such as polyphenols, phytosterols, carotenoids (such as lycopene), tocopherols, probiotics, etc. This concept refers to Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods (OJ L 404, 30.12.2006, p. 9).

### *Definition of low-cost provided to interviewees*

Food with *good nutrient profile* and with *good nutritional density*, particularly if sold with a nutritional claim, is usually sold at a higher market price (because of higher costs of production and of higher margin expectations) compared with food without specific nutritional characteristics. Interviewees were asked to provide opinions about healthy food, as defined above, sold at a market price lower than the common market prices. The healthy food being referred to could have been produced or sold (or not produced or sold) by the company the interviewee worked for.

## Appendix B

<b>Relations between Food Manufacturers and Retailers</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BIS. High bargaining power of suppliers of ingredients for low-cost healthy food (due to, i.e., limited number/monopoly of suppliers, scarce/no possibility to switch to other suppliers, high price of alternative suppliers)	Golan et al. 2008, Kadiyali et al. 2000
BSR. Manufacturers favour relationships with retailers supplying the same 'old' products rather than proposing new products such as low-cost healthy food	Kadiyali et al. 2000, Vander Wekken 2012
BRP. Increasing power of retailers over what will be commercialized impedes food manufacturers interest in low-cost healthy food	Burch and Lawrence 2005, European Commission 2009a, Kadiyali et al. 2000, 2009b, Wardle and Baranovic 2009
BLC. Lack of coordination and commercial agreement between manufacturers and retailers (in terms of production and commercialization) limits interest of manufacturers and retailers in low-cost healthy food	European Commission 2009a, 2009b, Kadiyali et al. 2000, Vlachos and Bourlakis 2006, Wardle and Baranovic 2009
<i>Solutions</i>	
SBCC. Better coordination and commercial agreement between manufacturers and retailers (in terms of production and commercialization) increases interest of manufacturers and retailers in low-cost healthy food	European Commission 2009a, 2009b, Kadiyali et al. 2000, Wardle and Baranovic 2009
SALI. Increased availability of ingredients for low-cost healthy food	Golan et al. 2008, Kadiyali et al. 2000
<b>Price</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BHP. At-risk-of-poverty consumers' perception of high price of healthy food, even if low-cost	Vander Wekken et al. 2012
BPG. At-risk-of-poverty consumers' perception of high gap in price between healthy food, even though low-cost, versus their familiar food	Vander Wekken et al. 2012
BLQ. At-risk-of-poverty consumers' perception of low quality of low-cost healthy food	Ajzen 1991, Bogue et al. 2005, Lähteenmäki et al. 2010, Nestle et al. 1998, Vander Wekken et al. 2012
<i>Solutions</i>	
SA. Affordability of healthy food would stimulate at-risk-of-poverty and low-income consumers' interest in this kind of food	Vander Wekken et al. 2012
<b>Innovation and Differentiation</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BLD. Manufacturers and retailers think that low-cost healthy food cannot be sufficiently well differentiated/does not have a valuable competitive advantage over other food	Lähteenmäki et al. 2010, Nestle et al. 1998, Vander Wekken et al. 2012
BLPS. The lack of private standards focused on healthy food production, commercialization and distribution limits consumers' interest in healthy food	Brambila-Macias 2011

**Appendix B -Continued**

<b>Innovation and Differentiation</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BIP. High price of ingredients to be used for low-cost healthy food	Kadiyali et al. 2000, UN 2011
BRFR. Manufacturers and retailers believe low-cost healthy food has a high financial risk	Burch and Lawrence 2005, Harvey et al. 2002, Vander Wekken 2012
BPNH. High margin of performance of other food in comparison to low-cost healthy food for manufacturers and retailers	Boesso et al. 2009, Burch and Lawrence 2005, Harvey et al. 2002, Vander Wekken 2012
<i>Solutions</i>	
SCR. Defining complementary roles in innovation processes between manufacturers and retailers for low-cost healthy food production/commercialization; for example, food manufacturers focused on quality innovation and retailers focused on understanding and flexibly adjusting to food market response to low-cost healthy food	Hooker and Downs 2014, WHO 2013
SHPS. Commercializing food produced with private standards for healthy food can increase the intention of consumers at-risk-of-poverty to buy healthy food	Brambila-Macias 2011, Hooker and Downs 2014, WHO 2013
SMEP. Raising manufacturers and/or retailers' standards in favour of healthy food can create barriers to marketplace entry of other manufacturers and/or retailers	Brambila-Macias 2011, Hooker and Downs 2014, WHO 2013
SLIP. Decreased prices of ingredients for low-cost healthy food	Golan et al. 2008, Kadiyali et al. 2000, UN 2011
<b>Competitiveness Strategies</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BNPS. Positioning strategy of manufacturers and retailers not sufficiently focused on low-cost healthy food	Lang et al. 2006, Wardle and Baranovic 2009
BBC. Insufficient competition between manufacturers and retailers over healthy brand reputation/positioning	Lang et al. 2006, Wardle and Baranovic 2009
<i>Solutions</i>	
SIPS. Food manufacturers' or retailers' increased positioning strategy focused on low-cost healthy food	Hooker and Downs 2014, Lang et al. 2006, Wardle and Baranovic 2009, UN 2011
SBC. Food manufacturers and retailers competition over healthy brand reputation/positioning favours propensity to healthier food (re)formulation	Hooker and Downs 2014, Lang et al. 2006, Mancino et al. 2008, UN 2011, Wardle and Baranovic 2009, WHO 2013
SHC. Introducing or strengthening the supporting role of retailers and/or food manufacturers in favour of public health campaign and healthy food consumption	Caraher and Coveney 2004, European Commission 2009b, UN 2011
SHR. Food manufacturers' or retailers' provide consumers recipes for low-cost healthy food/meals	Food Marketing Institute 2012, Gloria and Steinhardt 2010, WHO 2013
SNCC. Conduct nutrition education classes and cooking classes, including shopping and food budgeting guidance, at the retailers' store targeted at risk-of-poverty/low-income population	Food Marketing Institute 2012, Gloria and Steinhardt 2010, Hartmann 2013, Worsley et al. 2014

**Appendix B -Continued**

<b>Private Label</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BGPL. Consumers' increasing interest in private label vs. commercial brands limits food manufacturers' intentions to invest in low-cost healthy food	Bunte et al. 2011, Burch and Lawrence 2005, Kadiyali et al. 2000
BNPL. Retailers' very limited interest in private label lines for low-cost healthy food	Bunte et al. 2011, Burch and Lawrence 2005, Kadiyali et al. 2000
<i>Solutions</i>	
SIPL. Inserting low-cost healthy food in the market within a private label	Bunte et al. 2011, Burch and Lawrence 2005, Kadiyali et al. 2000
<b>Public Policy and Regulations</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BND. Lack of an official definition of healthy food	Duvaleix-Treguer et al. 2012, UN 2011, WHO 2013
BNMAK. Inadequate awareness and knowledge of manufacturers about nutritional issues	Lang et al. 2006, WHO 2010a
BNRAK. Inadequate awareness and knowledge of retailers about nutritional issues	Lang et al. 2006, WHO 2010a
BNCAK. Inadequate awareness and knowledge of at-risk-of-poverty consumers about nutritional issues	Ajzen 1991, Bogue et al. 2005, Costa and Jongen 2010, De Irala et al. 2000, Dickinson-Spillman and Siegrist 2011
BPP. Lack of adequate public policy intervention concerning the promotion of healthy food for at-risk-of-poverty and low-income people	Brambila-Macias 2011, Golan and Unnevehr 2008, Grunert and Wills 2007, Hess et al. 2012, McCarthy et al. 2013, Wardle and Baranovic 2009, WHO 2013
<i>Solutions</i>	
SMAK. Improving awareness and knowledge of manufacturers about nutritional issues	Lang et al. 2006, WHO 2010a
SRAK. Improving awareness and knowledge of retailers about nutritional issues	Lang et al. 2006, WHO 2010a
SCAK. Improving awareness and knowledge of consumers about nutritional issues, with specific focus on those at risk of poverty	Ajzen 1991, Bogue et al. 2005, Dickinson-Spillman and Siegrist 2011
SD. Agreement about an official definition of healthy food	Duvaleix-Treguer et al. 2012, UN 2011, WHO 2013
SPP. Promotion of low-cost healthy food recipes (for example, low budget, limited available time) by web, funded/promoted through national schemes	Brunso et al. 2004, UN 2011, Wardle and Baranovic 2009
SPC. Providing publicly funded communication campaign about low-cost healthy food	Brunso et al. 2004, Hawkes et al. 2012, UN 2011, WHO 2013
SPR. Public policy and public regulations can contribute to guaranteeing low-cost healthy food production, commercialization and distribution	Brambila-Macias 2011, Duvaleix-Treguer et al. 2012, UN 2011, Wardle and Baranovic 2009, WHO 2013
SFI. Identifying financial incentives and disincentives to leveraging the supply chain in the direction of low-cost healthy food	Brambila-Macias 2011, Duvaleix-Treguer et al. 2012, Golan et al. 2008, Hawkes et al. 2012, UN 2011, Wardle and Baranovic 2009, WHO 2013

**Appendix B -Continued**

<b>Public Policy and Regulations</b>	<b>Sources of Literature</b>
<i>Solutions</i>	
SLP. Introduction of policies affecting commodity (ingredient) prices could result in product reformulation to less expensive, healthier inputs	Brambila-Macias 2011, Duvaleix-Treguer et al. 2012, Golan et al. 2008, Hawkes et al. 2012, Mancino et al. 2008, UN 2011, WHO 2013
SL. Introduction of a regulation in favour of labelling healthy food	Duvaleix-Treguer et al. 2012, Grunert and Wills 2007, Hess et al. 2012, UN 2011, WHO 2013
<b>Food Accessibility</b>	<b>Sources of Literature</b>
<i>Barriers</i>	
BLA. At-risk-of-poverty consumers' lack of access to low-cost healthy food	Beaulac et al. 2009, Cummins et al. 2005, Kyureghian et al. 2013, Larson et al. 2009, Pomeranz 2012, Walker et al. 2010
BEUF. Consumers' easy access to food that is not healthy	Dibsdall et al. 2003, Pomeranz 2012
<i>Solutions</i>	
SIA. Improving access of consumers at risk of poverty to low-cost healthy food (for example, increasing commercialization and distribution in areas with risk of poverty and making low-cost healthy food easily reachable by those at risk of poverty)	Beaulac et al. 2009, Cummins et al. 2005, Kyureghian et al. 2013, Larson et al. 2009, Walker et al. 2010

**Appendix C**

The MDU technique of elaboration has been applied by including the 42 questionnaires, and the missing data (3%) have been treated by substituting the missing value with the median value achieved by the proposition. Evaluation of each map concerning the capability of adapting or producing degenerating results is conducted through the analysis of three groups of parameters (Busing et al. 2005). The first group, named *badness-of-fit*, includes *Normalised Stress* ( $\sigma_n$ ), *Kruskal's Stress- I* ( $\sigma_1$ ), and *Kruskal's Stress- II* ( $\sigma_2$ ) (Kruskal 1964, Borg et al. 2005). Resulting  $\sigma_n$  values close to 0 express the effectiveness of the cognitive map to collocate stimuli, that is statements, and respondents so that the visualised map best represents the interviewees' opinions. Nonetheless, another point of consideration is that, even though low values of  $\sigma_n$  indicate that the solution achieved is well adapted to data, data cannot assure that the solution is not degenerating. Thus  $\sigma_1$  and  $\sigma_2$  are adopted as indices that can better express the possibility of achieving degenerating solutions. According to the creation of these indexes (Borg and Groenen 2005, Busing et al. 2005), high values for  $\sigma_1$  and  $\sigma_2$  show the intensity of a possible degeneration of the represented phenomenon. In addition,  $\sigma_1$  is always inferior to  $\sigma_2$ . The second group of parameters refers to the means of the squares of Pearson's coefficients of correlation between preferences and distances (*variance accounted for* VAF), *Spearman's Rho* (RHO), and *Kendall's Tau-b* (TAU), all included in the category named *goodness-of-fit*. The VAF index in particular represents a measure that is ranged between 0 and 1, where values close to 1 express the capability of the model to approximate the opinions of the interviewees. The third group of parameters aims at measuring the degree of degeneration of the solution by considering Shepard's rough nondegeneracy index (Busing et al. 1997) and DeSarbo's intermixedness indices (DeSarbo et al. 1997). Shepard's index shows that the solution is not degenerative when its value is close to 1 (interval range 0–1). DeSarbo's indices represent the goodness in terms of the degree of degeneration of a solution; within a scale of values that goes from 0 to 3, the best is close to 0. The analysis of these three groups of parameters were effectively applied for each map and no concerns resulted.