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The Dynamics of the Innovation System for Functional Foods in South Brazil

Maria D. de Barcellos¹, Daniele Pozzo², G. C. Ferreira² and R.L. Lionello¹

¹*Federal University of Rio Grande do Sul (PPGA/EA/UFRGS), Porto Alegre, RS, Brazil*

²*Pontifical Catholic University of Rio Grande do Sul (PPGAd/ PUCRS), Porto Alegre, RS, Brazil*

*mdbarcellos@ea.ufrgs.br; danielle.pozzo@acad.pucrs.br; gcferreira@pucrs.br,
rafaelaitano@hotmail.com*

Abstract

This study aims at identifying the dynamics of the innovation system for functional foods (FF) in Rio Grande do Sul, Brazil. Functional food is any healthy food claimed to have a health-promoting or disease-preventing property beyond the basic function of supplying nutrients. Health has been named as the most significant trend and innovation driver in the global food and drinks market. Brazil is one of the leading countries in food production and consumption, and the market for functional foods have been growing 10% per year, three times more than the market for conventional foods. Although this food category is considered mature in some developed markets (such as in Japan, in the Nordic countries and in the U.S), it is still unknown for many consumers, especially those located in developing countries. On the other hand, functional foods has been attracting the attention of multinationals and local food industries, since innovation can significantly impact on their competitive advantages. Therefore, in this study, first we are going to investigate consumers' motivations, attitudes and intention to buy functional foods, since the market demands a better understanding of this trend. A survey with 450 consumers was conducted and provided quantitative insights. Secondly, we identified the availability of functional food products in the local retail market, through observation techniques. Our aim was to confront consumers' needs with local food companies' market supply. In a further stage, we are going to analyse the functioning of this innovation system, describing the agents involved in this context and their relations through in-depth interviews with local representatives (stakeholders). Innovation system is here understood as the set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such "it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." (Metcalf, 1995). Hence, we are investigating issues such as: Are local food companies ready to innovate in such a competitive and dynamic scenario? How can this system respond to consumers' demands? Are there conditions for an innovative food network in South Brazil? Our contributions help to shed light into these questions. Preliminary results indicate that the innovation system for functional foods in Rio Grande do Sul is incipient, but it is developing fast. Stronger governance and co-ordination strategies are needed. There are few local functional food products in the market, but those are attractive to consumers and indicate promising opportunities. The survey shows that interviewed consumers presented positive attitudes towards functional foods and enough purchasing power to buy it. Nutritionists and other health professionals have high credibility and could help inform consumers about the benefits of particular categories of functional foods. Food industry itself is not regarded as the most trustworthy source. Finally, this study shows that the understanding of Brazilian consumers is fundamental to help food companies define their strategies. To map the most accepted categories

of functional foods is also important, aiming to avoid the “tentative and error” approach.

1 Introduction

In recent years, the quest for increased competitive advantage has driven many organizations to innovate (Coutinho and Ferraz, 1995; Castilhos and Passos, 1998). The economic growth, traditionally attached to supply and demand, is now a synonym of imbalance and detachment a company can obtain in its own industry, if compared to the others (Schumpeter, 1982).

Technology, up to this point incidental, became a crucial tool in the strategic management and market positioning. Innovation also became increasingly dynamic due to the short lifecycle of products (Castilhos and Passos, 1998; Cooke, Uranga and Etxebarria, 1997). By definition, innovation is the implementation of new (or significantly improved) product (or service), process or organizational method (OECD, 1997). This, however, is not obtained by a company on an isolated perspective, but by the interrelation of that company with several other factors and agents, contributing to diverse functions in the development or diffusion of innovations (Nelson, 1993; Freeman, 1995; OECD, 1997).

In this context, an “innovation system” is conceptually defined as a system involving agents, policies and technologies that interact in a dynamic way to generate one or more innovations (Freeman, 1995). It is composed by a set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such “it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies” (Metcalf, 1995).

The discussion on “innovation system” is quite recent in Brazil, and at this stage its base elements are still being mapped and developed. Yet, a diversity of approaches to the subject entails the existence of several analytical gaps, including the studies already undertaken (Kretzer, 2009).

Therefore, understanding the dynamics of innovation in the Brazilian context is imperative for the country’s strategic positioning towards to the world market, while assisting the domestic agents to reorganize in order to optimize their outcomes (Coutinho and Ferraz, 1995). Innovation provides corporate vitality, enhanced performance and a much needed opportunity to differentiate from competitors. Moreover, a recent study found innovation to have a positive impact on growth in net revenues of 62 companies from the chemical sector in Brazil (Brito et al., 2009).

Particularly in the food industry, innovation is an important source of differentiation and a value-adding opportunity for managers to develop new products. Hence, innovation constitutes a competitive advantage in the globalised agri-food scenario (De Barcellos et al., 2009).

Health has been named as the most significant trend and innovation driver in the global food and drinks market. Brazil is one of the leading countries in food production and consumption, and the market for functional foods have been growing 10% per year, three times more than the market for conventional foods (Euromonitor, 2010). Functional foods therefore represent an important segment for innovation, since these foods are not intended only to satisfy hunger and provide humans with necessary nutrients, but also to prevent nutrition-related diseases and increase physical and mental well-being of consumers (Menrad, 2003).

For instance, PepsiCo, the food and beverage giant, is planning to focus on innovation, emerging markets and enhancing its nutrition business as a means of driving growth. Such ambitions include tripling its annual nutrition revenues from \$10 (€7.1bn; £6.2bn) to \$30bn by 2020, to which end PepsiCo has established a new nutrition centre, to be based at the organisation's Chicago office (Warc, 2011).

In spite of such expressive growth and increasing interest by multinationals and retail chains, the innovation system of functional food and this food category in specific is still unknown for many consumers, especially those located in developing countries. We thus outline in this paper consumers' motivations, attitudes and intention to buy functional foods in South Brazil, since the market demands a better understanding of this trend. Secondly, we identify the availability of functional food products in the local retail market, through observation techniques. Our aim is to confront consumers' needs with local food companies' market supply. In a further stage (not presented in this paper), we are going to analyse the functioning of this innovation system, describing the agents involved in this context and their relations. In-depth interviews with local representatives (stakeholders) of the innovation system of functional foods in South Brazil are undergoing and will be reported in details in a future study.

This paper is structured in the following way: first, we present a brief description about the concept, and discuss the dynamics of the innovation system for the functional food market (in specific in Brazil). Consumer behaviour in South Brazil and their attitudes towards functional foods are then discussed, in the light of theory. Finally, a methodological section is presented, followed by results, discussion and main conclusion of this study.

2 Functional foods

In last century, advanced research in nutrition led to the discovery of nutrients and their requirements for the development, growth and maintenance of the body. The concept of a "balanced diet" has been the main driving force in support of the elaboration of dietary recommendations and food guidance. But, at the turn of the 21st century, new challenges arise in nutrition science. The definition of health is no longer restricted to the absence of disease, but it includes physical as well as mental and psychological well-being. Food is not only required for body development, growth and maintenance but it is also recognised to play a key role in the quality of life (Ashwell, 2002).

"Food feeds more than the body; it also feeds our moods, our self-image, and our relationships. Since humans moved from being 'hunters and gatherers' to social animals, food has played a significant part in human relationships and has a complex stream of social meanings around it. It is often used as a transactional gift in relationships which carry emotional benefits of major significance" (IPA, 1994)

The term "Functional Foods" (FF) was first introduced in Japan in the mid-1980s and refers to processed foods containing ingredients that aid specific body functions, in addition to being nutritious. Currently, there is no universally accepted term for functional foods. A variety of terms have appeared world-wide such as nutraceuticals, medifoods, vitafoods and the more traditional dietary supplements and fortified foods. However, the term functional food has become the predominant one even though several organizations have attempted to differentiate this emerging

food category (FAO, 2007).

Therefore, the term “functional food” refers to a food that provides a health benefit as well as nutrients. The term can also refer to whole foods, to fortified, enriched or enhanced foods, and dietary supplements that have the potential to improve mental and physical well-being and reduce the risk of diseases. The ingredients responsible for this benefit can be naturally present or may have been added during processing. The levels of nutrients in foods can be increased beyond their natural levels to create an enriched product. Fortified products contain nutrients or ingredients that were not present in the original food.

The concept was further developed in the United States and in Europe, although nowadays there is a global (and growing) market for ‘functional foods’.

Functional food is a dynamic market, which offers excellent prospects for growth for well-positioned food and drink manufacturers. Value sales had risen by 40% over the 2003-2008 period. The rise of functional foods occurred at the convergence of several critical factors (Euromonitor, 2004), such as:

- Awareness of deterioration in personal health, led by busy lifestyles with poor choices of convenience foods and insufficient exercise.
- Increased level of information from health authorities and the media on nutrition and the link between diet and health, which created a more educated consumer.
- Scientific developments in nutrition research, leading to a number of discoveries of ingredients with health properties which could be incorporated into foods.
- Increased incidence of self-medication, led by government reduction on healthcare expenditures, leading to increased sense of personal responsibility for healthcare.
- A crowded and competitive food market, characterised by pressured margins, creating a financial imperative for food manufacturers to seek out methods of differentiating their products and boosting flagging margins.

According to data published by FAO (2007), the functional markets grow steadily each year, with annual growth rate estimates varying between 8% and 14%. This trend is likely to continue as changing population demographics (e.g. an ageing population) and the effects of lifestyle diseases create greater demand for food products targeting health and wellness.

Williams et al., (2006) indicate that demand for functional foods within the developing countries is growing, presenting a lucrative opportunity to develop domestic markets. For instance, India, with its strong tradition of eating healthy foods, ranks among the top ten nations in buying functional foods and the market size is expected to nearly double in the next five years. In Brazil, the sector is relatively young, but grows rapidly with sales value estimated to reach US\$1.9 billion by 2009. In China, the total functional foods market is approximately US\$6 billion per year, which is expected to double by 2010.

2.1 *The Dynamics of the Innovation System for the Functional Food Market*

The functional food market is still in an experimental phase. It is characterised by a very high level of product failures, even from experienced and well-established food companies, such as Nestlé (LC1) (Just-Food, 2001).

Typically, the more successful products tend to have a fairly mainstream positioning. They are marketed through mass-market distribution outlets (such as supermarkets, rather than health food shops), are produced by a well-known food company or as a brand extension of a well-known brand, and they are positioned as generally contributing to wellness, rather than targeting a specific illness. Products which have fared less well tend to have taken the opposite positioning, which has left them restricted to a niche market positioning. Overly clinical products, which appear closer to medicines than to food, tend to deter consumers. This includes foods launched by pharmaceutical companies, those focused on alleviating a particular complaint and those that use doctor recommendations and overly scientific explanations of their benefits. Although these may offer more cutting-edge benefits, they are not well understood by the consumer, and are not perceived as “food” in the same sense (Euromonitor, 2004).

Successful products do not promote their health benefits in a vacuum – they also pay close attention to other selling points, such as taste, convenience and price. For a functional food to perform well, it should be competitive even without the health benefit factor (Verbeke, 2006).

The rise in health awareness, which gave birth to functional food, also stimulated interest in other types of food, which act in competition to functional products. Most notable of these is the category of naturally healthy foods, such as wholegrains, oats, soy, cranberries and green teas, among others. These products can also leverage the health benefits of their nutrients as a selling point, and they are therefore positioned very close to functional foods and offer considerable threat. Functional foods are also under pressure from “better for you” foods, such as those with reduced fat or sugar content, and from organic foods. Indeed, controversy over the food chain following a number of food scares has catalysed increased demand for “pure” organic foods and could potentially damage sales of functional foods, which in some cases are viewed as “adulterated”. This view is exacerbated by bad publicity regarding genetically-modified (GM) foods, which are sometimes confused even with the more basic functional foods (Blendon et al., 2007; Euromonitor, 2004).

Consumers tend to reject too much novelty in food, thus constituting strong barriers to genuine innovation (De Barcellos et al., 2010; Van Wezemael, 2010). Besides also present a slow rate of change on eating preferences and habits. Nonetheless, innovative consumers represent a key market segment. They play an essential role in the success of a new product by legitimizing the novel product to other consumers (Huotilainen, Pirttilä-bäckman and Tuorila, 2006).

Hence, innovation in the food sector is still a challenge. Costa and Jongen (2006) state that the European food and beverage industry is quite conservative in the type of innovations it introduces to the market, displaying much lower research and development (R&D) investments than industries in other sectors. Some possible explanation, according to studies by Cooper (1994) and Costa and Jongen (2006), is that many food product introductions fail. Research across six European countries shows that only a fifth of new launches are successful (defined as achieving monthly sales of 80 per cent of the average for the category in question). These launches include completely fresh brands, line and flavour extensions and new pack sizes (Benady, 2008).

As a consequence of such negative product introduction results, the food sector strategy is characterised by a parsimonious development of innovations. Much of the innovation is based on brand extensions of the same product line which is a less risky strategy (Grime, Diamantopoulus

and Smith, 2002). Previous study in Brazil identified that food industry could be missing an opportunity by not being innovative enough. The innovative products launched by the drinks and beverage sector seemed to be leading consumers' experiences, therefore pointing to the food industry that more could be developed (De Barcellos et al., 2009).

Hobbs (2001) highlights that supply chains for functional foods evolve in an environment of uncertainty. In large part, this is because the products are based on new and evolving technologies, selling into new and evolving markets. While this presents an opportunity to target new "niché" markets, it brings with it added challenges. A summarizing figure is presented to capture some of the strategic choices this kind of industry might follow (Fig.1). One of the underlying assumptions proposed by Mark-Hebert (2004) is that the food industry is facing a challenge of changing attitude towards food production. In this perspective a faster moving market requires a strategy that combines "market pull" and "technology push" as driving forces for the innovation process.

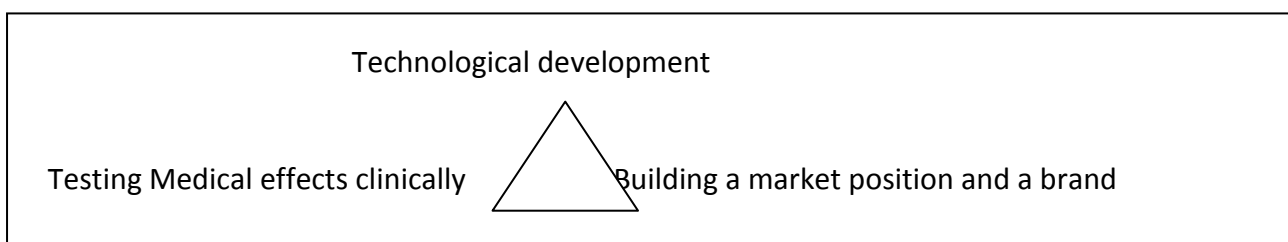


Figure 1. Three corner stones for creating added value in developing functional foods; technological development, testing medical effects clinically and building a market position
 Source: Mark-Hebert, 2004

According to Mark-Hebert (2004), businesses that want to succeed in this market will have to find new ways of conducting management and in identifying critical technologies. Companies will have to build internal skills, employ innovative external sourcing, develop new markets, establish alliances, develop packaging, build strong brands and find venture capital for new developments. As the author state, "these strategic options are quite uncharacteristic for the traditional food industry". It has characteristics of a changing market where flexible strategies are reflected in strategic collaborative development that is ahead of the development of legal frameworks, on the market as well as in individual companies.

Recently, new organizational forms such as clusters have been established in the food sector to promote innovation and enhance industry competitiveness (see for instance, the Foodcluster Holland or the French Food Cluster F²Cinnovation). In South Brazil, this idea is still embryonic, but developing (see for instance, the launch of a technological pole focused on functional food by a local University called Nutritech). Rosenfeld (1997:10) defined industry cluster as "a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue, that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats". The proximity among firms eases the coming into contact of firms and the sharing of resources, knowledge and capabilities. Clusters therefore promote innovation through technology and knowledge transfer, development of a skilled labor force in related industries, and the social infrastructure (Ferreira and Serra, 2008), but successful clusters are certainly dependent on an effective innovation system to flourish.

2.2 The Innovation System in Brazil: Understanding conditions to develop a market for the functional industry

In terms of institutional background favoring market developments for functional food industries in an emerging country like Brazil, it is important to understand the conditions behind this scenario. In that sense, we decided to search for studies that could help answering some of our research questions: Are local food companies ready to innovate in such a competitive and dynamic scenario? How can this system respond to consumers' demands? Are there conditions for an innovative food network in South Brazil? These empirical studies constitute the basis for the exploratory stage that will follow in this research. Table 1 therefore presents the main conclusions of 12 articles published in the last 15 years (from 1996 to 2010) discussing the features of the innovation system in Brazil.

Table 1. Selected studies published in the last 15 years discussing the features of the innovation system in Brazil.

N.	Author(s) and Year	Title	Main Conclusions relevant to the Brazilian Innovation System
1	Albuquerque (1996)	National innovation systems and industrial property rights: introductory notes from a necessary discussion.	The national innovation system in Brazil is still under construction. Its immaturity must be vanished starting from the development of <i>catching up</i> policies, generating, then, incremental innovations based on technology developed outside, which will push the economy up and also will increase the number of resident patents (which is nowadays a very inferior amount).
2	Cassiolato and Lastres (2000)	Innovation System: Politics and Perspectives	The innovation system of food and health involves a large number of training and specializations are necessary to obtain competitiveness (in general, not just in Brazil).
3	Conceição and Almeida Jr (2010)	Food Industry in Brazil and Technological Innovation	This paper analysed the food innovation in Brazil . It was verified the importance of Brazilian consumers in the development of innovation led by the food industry and also the relevance of cooperation to the success of innovative activities.
4	Kretzer (2009)	Innovation Systems: Contributions of National, Regional or Local Approaches	Analysing the national innovation system in Brazil from previous research, the author defined it as incipient, with low efforts in innovation; sources of technology come mostly from other countries and institutions that rarely interact between themselves.
5	Lemos and Nascimento (1999)	Cleaner Production as an innovation and competitiveness generator	Studying a rice plantation in Rio Grande do Sul , they detected that the continuous improvement (obtained, in this case, by the strategy of 'cleaner production') is a facilitator of innovation, which, consequently promoted to reach high competitiveness. The industry representatives interviewed recognised that the market of healthy and environmentally responsible foods is in an accelerated expansion. The innovation as a strategic tool is also perceived by the respondents.
6	Nassif (2007)	National innovation system and macroeconomic policies: brazil and india in comparative perspective.	The paper discusses the Brazilian innovation system scenario from financial and growth data. Since the 1980s when, according to the author, Brazil was inserted as a global competitive agent, the country has suffered with weak innovation policies, even with the increase of efforts to change this situation. It is also noted that, not only universities, but educational, research and qualification institutions in general are important, because they equally composes the national innovation system, promoting the connexion between science, technology and market. It is perceived a high potential of technological growth in Brazil.

7	Paz et al. (2005)	Sectorial Innovation Systems: an Application of the Concept in the Brazilian and French Fluid Milk Production Chain.	<p>The authors analysed, through previous case studies, the sectorial innovation system of fluid milk production chain in Brazil, in comparison to France.</p> <p>The basis of Brazilian system is made of incremental innovations and the system was characterised as fragile, due to the low technological development and interrelation between the agents.</p> <p>It was identified a low cooperation between the actors of the system and also an obstacle to system growth created by the bigger companies by selecting technologies that demand high financial investment.</p> <p>The advertising of products for the market (branding, more specifically) is shown as determinant for the establishment of innovative products, even when another brand is already solid on the market.</p>
8	Raud (2008)	Functional Foods: the new frontier of food industry – Analysis of the strategies of Nestle and Danone on yogurt Brazilian market	<p>The article discusses the insertion of Danone and Nestle in Brazil as pioneers on functional food market.</p> <p>The necessity of developing technology and research for the establishment of company on the functional food market causes a high demand of resources and, due to this entry barrier, only multinationals and national companies that cooperate to have more access to financial support (by joining different industries, as food and pharmacy, for example).</p> <p>The proximity to medicine area is also an advantage to industries focused on functional food. The food offer and advertising from Danone and Nestle in Brazil seems to be deeply related to health authorities (as ANVISA) regulations. The increase of market share showed that providing information to consumer is decisive to brands' success.</p>
9	Roese (2000)	Industry and science & technology policy: regional innovation systems? The furniture cluster case, in Bento Gonçalves, Rio Grande do Sul	<p>The author studied the cluster of furniture in the region of Bento Gonçalves (south Brazil) as the core of a local innovation system.</p> <p>Is was detected the existence of some degree of coordination between the entities involved, all run by labor/trade unions. There is interaction between the human resources offer and local technological production. It was observed as problems: the absence of aggressive policies (that could promote increase of resources and the development of radical innovations) and the entry barrier suffered by small companies that don't have enough structure to maintain the costs (which could be solved if the bigger companies cooperated and interacted with smaller ones for the increase of qualification and competitiveness for the sector). The paper suggests that the maturity of the system must be achieved with homogeneity, even with heterogeneous actors. Companies, research and education institutions and labor/trade unions are considered as agents of the system.</p>
10	Tartaruga (2010)	[The Innovation in the Territory and the Role of Universities: Preliminary note on Territorial Development in the state of Rio Grande do Sul]	<p>It highlights the problems in university-companies relationship in the state of Rio Grande do Sul, focusing specially in extractive and transformation manufacturers. The misunderstandings between universities and companies seem to be related to cultural and historical issues. According to PINTEC (National database of innovation researches), the state has a great national relevance on innovative processes.</p>
11	Viotti (2002)	National learning systems: a new approach on technological change in late industrializing economies and evidence from the cases of Brazil and South Korea.	<p>The author characterises the Brazilian innovation system as passive in its learning system, due to the position in the creation of innovations (usually, incremental innovations). The low rate of resident patents would justify the classification as a 'passive' innovation system, due to the fact that innovation doesn't start from Brazilian researchers. It is also emphasized the absence of policies focused on innovation and the insufficient resources to follow all the efforts on the development of science and technology.</p>
12	Zackiewicz, Bonacelli and Salles Filho (2005)	[Prospective Studies and Organization of Innovation Systems in Brazil]	<p>From a international literature review, the authors propose discussions for Brazil, emphasizing the importance of innovation culture and institutional compromise for the success of the national system.</p>

In sum, it is possible to depict that the national innovation system in Brazil is still quite fragmented. Currently, Brazil has a reasonable development in research, however there seem to be a gap in the subsequent step, which is to transform the generated knowledge into new products and processes. It is the technological development, still in its infancy, which may offer more ground to innovation and consolidation of a national innovation system as such.

Considering the participating institutions: universities and research institutions, private companies and government bodies (regulation agencies and financial agents), the system is presently well-built. However, there is a lack of governance and strategic coordination between these agents hindering the development of innovations in a more efficient and effective way. For this consolidation it would be necessary not only to establish defined strategies to achieve goals and means, but also to create a link between the agents of the system. This weak “bond” among them was cited in some studies as a significant limitation for Brazil. Another limitation is that due to this lack of strategies, much of the generated knowledge does not become “innovation”, reason why the national industry continues using foreign technology.

Furthermore, the studies confirm the existence of a consumer market with growth potential (in terms of volume and income), a developed scientific knowledge base, a well-established production structure and growing financial investments and resources for innovation (Sector Funds, for example). Specifically in regard to functional foods it is suggested a cooperation between the food and the health system, since the development of functional foods may benefit from the knowledge of both areas.

In our study, we identified the need of further examination into these network dynamics. Empirical data presented above gives us first insights and the necessary framework to properly investigate this issue. Nevertheless, due to time constrains, primary data based on the interviews with stakeholders in the innovation system for functional food in South Brazil are not available to this point, reason why we shall present this analysis in a future opportunity.

Yet, obtained market will results help us understand consumer attitudes towards functional foods and to identify the product offer available in South Brazil, an emerging and promising market. In the next section, we therefore discuss consumer behaviour towards functional food in theory, moving afterwards to our research method, findings and final remarks sections.

2.3 *The functional food consumer*

The functional food market can be characterised as “technology-push”, which is predominately oriented by the research of new opportunities for innovative products by companies and, in a smaller proportion, by consumers’ demand. For Scholderer and Barcellos (2008), a great part of P&D activities is still accomplished in an experimental concept, following the logic of attempt and error, with a very small effective use of applied research in consumer’s behaviour. Consequently, there is a high failure rate in the release of new products, even those coming from expert and well-established companies, such as Nestle (LC1) (Raud, 2008).

In general, the key factors influencing the intention to consume functional foods (Urala and Lahteenmaki, 2007) are flavor, quality, price/value, convenience and expected health effects. Therefore, functional foods must attend consumers’ desires for convenience, health and flavor, simultaneously (Gray et al., 2003).

However, it is relevant to observe that functional foods, for having so many categories, are not perceived as a homogeneous group by consumers (Urala and Lahteenmaki, 2003). Also, the attitudes and lifestyle - other than demographic factors as gender, age or education - deeply affect the acceptance and consumption intention of functional food (Urala and Lahteenmaki, 2007) and, therefore consists in important elements on consumer's segmentation.

One of the consistent results from researches (Bech-Larsen and Scholderer, 2007; Frewer, Scholderer and Lambert, 2003) is that consumer's orientation related to health varies, systematically, according to gender and age. Generally, women tend to be slightly oriented to health than men, as middle-aged and elderly consumers are inclined to be substantially more oriented to health than younger ones.

According to Frewer et al. (2003), the main reason for women being more conscious about health appears to be related to their sense of responsibility to the family welfare (also directed linked to women as the dominant role on family food acquisition). For middle-aged and elderly consumers, that occurs only because these individuals have a higher probability of being diagnosed with some disease than those who are younger.

A second discovery from researches, in consumer's behaviour area (Verbeke, 2005; Frewer et al., 2003), indicates that functional ingredients successfully established and with a more general health claim are more likely to be accepted than non-familiar ones or those just attractive to consumers with advanced medical and nutritional knowledge. Therefore, it becomes easier to obtain the acceptance from consumers of functional foods enriched with bioactive compounds already known from its benefits to health (for example calcium, vitamin C or Omega-3) than compounds unknown for the general public (as peptides, Selenium and Xylitol).

In third place, consumers don't always accept the 'combination' between the 'carrier' food (the base-food, as yogurt in the probiotic case) and the functional ingredient (Siegrist et al., 2008). The main reason behind it is the fact that consumers create an disadvantageous expectation related to taste when there is an incompatibility between the carrier and the functional ingredient (for example, when a fruit yogurt is enriched with Omega-3, it creates the immediate association to the extraction of the ingredient from fish oil and it could, consequently, changes negatively the yogurt flavor).

In addition, it is believed, generally, that consumers evaluate functional foods the same way they do conventional food. It means that functional benefits can add value, but should not exceed the natural sensorial properties of food, as flavor (Verbeke, 2006).

2.3.1 Attitudes toward functional food

Attitudes have many functions referred to human behaviour: they orient perception and influence directly consumer's behaviour (Ajzen and Fishbein, 1980; Ajzen, 1991). One attitude can be defined as "one psychological trend that express itself when individuals evaluate specific products or objects and manifest determined degrees of acceptance or rejection (Eagly and Chaiken, 1993). Thus, as attitudes influence deeply the choice behaviour, they can be used to explain the different choices that consumers do (Tuorila and Cardello, 2002).

For Eagly and Chaiken (1993), attitudes become more stable when the object becomes familiar (in this case, functional foods). However, attitudes can change rapidly, thanks to the fast alterations in product availability and also due to the dimensions confidence and safety that are related to the aspects of innovation of functional foods. Thus, the attitudes related to health and innovation and the interest in natural products become fundamental to predict choices of functional foods (Bäckström et al., 2003).

The attitudes related to functional foods have been internationally studied and consistent research results have been described on literature (Urala and Lähteenmaki, 2003, 2004, 2007). In 2007, Urala and Lähteenmäki validated a scale formed by 25 variables and four main dimensions were identified. According to the authors, the dimensions can be described as follows:

- Reward for the consumption of functional food (FF REW): The main focus is that health, humor and welfare can be promoted by the consumption of functional foods. The pleasure resulted from the idea of consuming functional food to take care of themselves is crucial to consumers' sensation of 'reward';
- Necessity of functional food (FF NEC): Describes the necessity for functional foods as the necessity for medicines. This dimension measures how necessary or unnecessary are the functional foods to society in general;
- Confidence in functional food (FF CON): Describes the confidence of consumers on functional foods as foods which promotes health and the reliability of researches related to them and;
- Safety of functional food (FF SAF): This dimension (Urala and Lähteenmäki, 2004) focus the possible nutritional risks when functional foods are consumed.

Thus, Urala and Lähteenmäki (2007) correlates attitudes toward functional foods with background attitudes, aiming a deeper comprehension about the consumption behaviour of this kind of food. For this purpose, the authors used scales of General Health Interest (GHI and also interest in natural products) from the Roininen, Lähteenmäki and Tuorila (1999) study, which showed positive and moderate correlation for GHI itself and negative correlation of 'interest in natural products' with attitudes toward functional food. The attitude towards innovation in food was measured by the Food Neophobia Scale (FNS, from Pliner and Hobden, 1992) and didn't present correlation to the attitudes toward functional food in the analysed sample.

Through the comprehension of consumers' attitudes, it is possible to predict the intention about the consumption of functional food (Urala and Lähteenmäki, 2007). Consumers' attitudes can also be strategically used on the initial states of the new products development, as a support tool in the selection of alternatives for further progress.

3 Method

3.1 Characterisation of the study

In its initial stage, this study is characterized as exploratory in nature, which aims to "provide a framework that can facilitate the process of deduction of relevant issues in the investigation of a phenomenon" (Tripodi, Fellin and Meyer, 1981). This type of study is justified on the basis of character description and exploration of a phenomenon, in this case, the characterization of the innovation system and the consumer market for functional foods, issues that are not sufficiently known in Brazil, an emerging country from South America.

At first, we used secondary data from the literature to characterize the existing innovation system in Brazil. A literature search was undertaken and 12 scientific papers published in peer reviewed journals between 1996 and 2010 were selected. Such studies provided specific features and characteristics of the innovation system in Brazil and helped us to better understand the existing scenario for the development of functional food industry. This theoretical base (presented in section 2.2), besides characterizing the innovation system through empirical studies, had served as the basis for developing an interview protocol that is being applied with stakeholders in the innovation system of functional foods in South Brazil. Unfortunately, due to time constraints, these results will not be presented here. This qualitative stage of in-depth interviews with the system's agents is ongoing and will be present in the future.

Also based on secondary data, we present in the results section an analysis of factors influencing food consumption in Brazil, since attitudes towards production and manufacturing functional foods are highly related to the market profile, as well as on consumer habits and their peculiarities. Data from different sources were obtained (such as academic papers, national statistics from the Brazilian Institute for Geography and Statistics and international market reports - agri-food trade services, Euromonitor, Datamonitor, Warc, others) and are presented at section 4.1.

At section 4.2 we present a characterization of the supply of functional products in Porto Alegre based on direct observation of available functional food products at local retail level. Using a spreadsheet-site observation we identified the type of functional food product, its category, the main benefit offer to consumer, the brand and status of the food processing industry (if national or multinational). We visited three retail stores and the products commonly found at these visits are described here.

In the next stage, we applied a survey, descriptive in nature, to 450 consumers. The objective was to map the consumption of functional foods in a sample of this population. As previously discussed, little is known about functional food consumers in developing countries. The survey was conducted in Porto Alegre, capital of Rio Grande do Sul state, located in south Brazil, on the border with Argentina and Uruguay. The city of Porto Alegre has 1.3 million inhabitants and it is considered the city with highest quality of life in Brazil by the United Nations (UN). It has more than one million trees in its streets and has more than 80 awards and titles that qualify it as one of the best Brazilian cities to live, work, do business, study and enjoy. Its quality of life indicators are highlighted in the main indices of human development: health, sanitation, education, environment and economy.

We chose to perform the research in Porto Alegre, for convenience and for being a cosmopolitan city, capital of this state and with potential for significant consumption of functional foods. In the future we will continue this research in São Paulo, one of the most cosmopolitan city in the world.

3.2 *Survey: Data collection and analysis*

The survey was conducted with 450 consumers in Porto Alegre, and we aimed to assess consumers' motivations, attitudes towards functional foods and purchase intention to consume it. Churchill (1999) and Malhotra (2001) comment that the method of cross-sectional survey is the most popular and widely used in descriptive research, and it is characterized by collecting information from a sample of the population only once. The method provides a "snapshot" of the variables of interest at a given moment in time.

Consumers were approached by trained researchers who administered the questionnaire personally, with the aid of scales and printed material support. The interviews took place over one week (from 18-24 October 2010), in sites close to supermarkets and stores specializing in food products. In total, 25 sites were selected within the city grounds, aiming to obtain greater variability in the sample. However, to comply with the proposed objective investigation, only consumers reporting to effectively consume functional food were interviewed. To assure the understanding of the concept, a written definition of functional food was provided to the respondent at the beginning of the interview, along with examples of real products. If the respondent had confirmed the consumption of any of the products cited, she/he was immediately recruited, beginning the interview.

The questionnaire was based on European studies of Urala and Lahteenmaki (2004, 2007), who developed a scale to measure attitudes specifically in relation to functional foods. In particular, it is important to note that in this study, for cultural reasons (and already documented in previous studies conducted in Brazil) items that contained potentially negative meaning were reversed to positive statements. Brazilian consumers are rather optimistic about life and have difficulties in dealing with reversed items. For them, it seems difficult to disagree with this kind of “negative” alternatives, whose answers are usually located in the extreme left of the scales.

In our questionnaire, the first question investigated the frequency of consumption of functional foods, followed by set of questions related to motivations and attitudes towards functional foods. Scales of general health interest (Roininen et al., 1999), the natural product interest (Roininen et al., 1999) and food neophobia (Pliner and Hobden, 1992) were also investigated, but are described somewhere else. Next, we investigated respondents’ the degree of confidence in the different stakeholders of the innovation system of functional foods.

Finally, the last set of questions aimed at investigating the perceptions of consumers in relation to existing functional foods, produced, manufactured and marketed by food industries in South Brazil. The selected products were grouped into four different categories (antioxidants, probiotics, heart health and energy drink) in order to analyze consumers’ degree of acceptance or rejection of these products. Consumers were therefore questioned about product familiarity (Tuorila et al., 2002), appearance, beneficence and healthiness (Urala and Lahteenmaki, 2004, 2007). Consumers’ willingness to buy each of the four different products was also assessed. To help consumers in this stage, individual cards containing a high definition picture of each product was presented. Each card also contained additional information such as brand name, name of the manufacturer and main benefits of the product. The description of the benefits was provided in accordance with package information. The following products/brands /manufacturers were investigated:

Table 2. Functional food products produced by local industries in South Brazil: category, brand, industry and offered beneficence.

Category	Brand	Industry	Beneficence
Probiotics	Piá Essence	Piá	Physiological regulator of the gastrointestinal tract, helping in the gut functioning
Antioxidants	Beneficence Bread	Seven Boys	Antioxidants that help the body to fight against free radicals, aiding you take care of your beauty
Heart health	NutriSoy	Josapar	Soy protein and its isoflavonoids (mainly genistein) offer protection against heart diseases, menopause symptoms, osteoporosis, breast and prostatic cancer
Energy drink	All Need	All Need	Stimulating drink suggesting more energy and productivity to body and brain

Finally, in the last section of the questionnaire socio-demographic questions about the respondents were asked.

3.3 *Data analysis*

Data were initially treated aiming to detect possible non-random missing data and outliers. Normality and multicollinearity check were also applied aiming to reduce any “noise” that could negatively interfere with further analysis. No problems were identified in this stage. Following this stage, univariate and multivariate statistics analysis were performed using the software SPSS v18.0. Interpretation of results and conclusions are presented in the next sections.

4 **Results**

4.1 *Factors influencing food consumption in Brazil: facts and emerging trends*

In this section, we are going to investigate (through secondary data) factors influencing food consumption in Brazil. It is very important to understand the main facts and emerging trends in this market, since the dynamics of the functional food innovation system in South Brazil is highly related to this larger picture.

Size and Agricultural Power

Brazil is a big country, with an emerging and growing consumer base, strong, growing economy and a strategic role in South America. It is a global agricultural power. Agriculture plays an important role in the country's economy, accounting for 10% of GDP and 40% of Brazilian exports. The country is the world's leading producer of meat (beef, poultry, pork), coffee, sugarcane, soybeans and oranges. In 2014, the Brazilian agricultural products market is forecast to have a value of \$49,739.9 million, an increase of 10.7% since 2009 (Datamonitor, 2010).

Demographic changes

Brazil faces demographic changes that are likely to have an impact on the way consumers purchase and consume foods. Brazil is aging quickly and seeing dramatic changes in its population distribution. In addition, life expectancy in Brazil has increased in past decades due mainly to an improvement in the quality of life and advances in medicine and health care. These trends will likely change consumption patterns, increasing the interest in more sophisticated and health-oriented products (Euromonitor, 2007). As such, nutraceuticals and functional foods in Brazil offer real promise.

The population pyramid is shifting, the level of education is increasing, and a middle class is emerging. Increased disposable incomes make Brazil a potential and attractive market for food producers and retailers. Brazil has over 60 million families or 191 million people. The Brazilian Institute for Geography and Statistics (IBGE, 2008a) forecasts that the population will surpass the 210 million mark by 2025. Brazil is a highly urbanized country with 81% of the population living in urban areas (IBGE, 2007a) and this feature give Brazilians a metropolitan and not always healthy way of eating. Yet, the population is becoming more educated, which have an impact on food consumption patterns. Higher education is usually associated with the regular consumption of a wider variety of foods. Higher levels of education also translate into increased access to information, which makes consumers more discerning and concerned about the foods they eat. Income is rising and the economical power of social classes C, D and E is facing rapidly and steady growth. Wealthiest consumers can spend more money in fruits and vegetables, as well as other premium and healthy food, due to their higher concern with health and shape.

More Work and Less Exercise

Brazilians work long hours, are changing the way they eat, and are leading a more sedentary lifestyle. These changes in eating and lifestyle behaviours are slowly adding extra pounds to the population as well as increasing the incidence of chronic, non-communicable diseases such as cardiovascular disease, diabetes, and cancer. Nearly 20% of the workforce works 49 hours or more a week. Brazil has also seen an increase in the number of people who work a 40-44 hour week (IBGE, 2007a). Only a very small percentage of individuals (3.3%) make time for the recommended 30 minutes of physical activity five or more days per week (Barreto et al., 2005).

Ethnicity and regional differences

Most Brazilians are descendants of colonial Portuguese settlers. In the late nineteenth and early twentieth century, there was a large influx of European immigrants, consisting primarily of Spanish, Italian, Japanese, and German farmers, who came to the country in a quest for prosperity and land. After numerous multiracial marriages between settlers, native Indians, and Black Africans, the Brazilian population developed unique characteristics. The Southern region has a strong predominance of white European immigrants in contrast with the Northern regions where there is a strong presence of Pardos (mixed-race of European and African backgrounds) and descendants from native Indians. In 2007, the population of Brazil was composed of 50% whites, 7% Black Africans, 42% Pardos, and 1% others (IBGE, 2007a). From a sociological standpoint, ethnicity plays an important role in influencing Brazil's patterns of food consumption and purchases. Because of the ethnic diversity, tastes and preferences vary across Brazil. The diversified cultural and ethnic backgrounds favors innovative attitude toward food products. Brazilians enjoy different and unique flavors and are open to trying new products (De Barcellos et al., 2009).

Health and wellness

Since the 1960s, cardiovascular diseases have become the leading cause of death in Brazil; today, they account for about two-thirds of the total deaths for known causes in the country (Barreto et al., 2005). In 2007, 44% of the population over 18 years old was overweight and 22% of the population was obese, predominantly women, those with low-incomes, and rural residents (IBGE, 2007). On the other hand, a good portion of the population is obsessed with a slim, desirable and young body image, relying heavily on plastic surgery, weight-loss diets, medications, and dietary supplements (Leibing, 2004). This group consists primarily of high-income women living in urban areas in the Southeastern region. In this group, the obesity rate has dramatically decreased in recent years (Coutinho et al., 2002; Barreto, 2005). In general, high quality diets in Brazil are directly associated with high income and a high level of education of the head of the family (Fisberg, 2006; Claro et al., 2007). It is important to highlight that although Brazil is seeing an increase in the general population body mass index, undernutrition is still a public health concern, particularly among lower-income children living in the Northeastern region (Coutinho et al., 2002).

The meaning of food and eating habits

Food for Brazilians is a source of pleasure and family gathering. In general, Brazilians love talking about food and nutrition. They are information seekers. They would like more advice on healthy eating and believe food labels should provide information on nutrition claims or any other consumer-friendly interpretation of the nutrition information available on the package (Coutinho et al., 2002). Brazilians' perceptions toward foods are changing as a result of globalization and urbanization. From a demand and consumption standpoint, people in Brazil are becoming less passive, more educated, and are showing a higher demand for quality food products. In large urban

centres, consumers place value on convenience, giving priority to supermarkets and hypermarkets that provide a faster way of shopping (De Souza et al., 2008). Regular diets typically consist of three main meals (used to be six in the past), including breakfast, lunch, and supper. The reasons for the decline in the number of meals are clearly associated with the modern lifestyle in large urban centres, the distance between work and home, and the desire for a slim body (Barbosa, 2007). Although the number of meals has been reduced, Brazilians are still snacking throughout the day, especially in the afternoons on sandwiches, pizzas, hamburgers, and deep-fried snacks. Breakfast is considered the most important meal of the day, which does not necessarily translate into the most nutritious or varied one. A typical breakfast in Brazil is composed of bread (Brazilian "French bun"), butter, coffee, and milk. The demand for yogurt and premium dairy is increasing, following per capita's affluence. Lunch and supper can bring a mix of various culinary styles due to the cultural and ethnic diversity of the country. Restaurants that sell their meals by the kilo are very popular in Brazil. These restaurants offer a large variety of dishes in a buffet format at affordable prices and convenience (usually located a few steps from work), which attract consumers wanting to taste ethnically and culturally diverse meals in a relatively fast food/efficient option (Euromonitor, 2008). Lunch is considered the heavier meal of the day, consisting of rice and beans, meat, salad, and vegetables. Supper tends to consist of lighter fare and could be a snack; it is the meal of the day which brings the family together in a more informal and relaxed manner (Barbosa, 2007).

Cooking and Convenience

Typically, Brazilian women are responsible for most of the cooking at home. The majority, however, feel overwhelmed by the responsibility of choosing the daily menu (70%) and avoid meal planning as much as they can. Some level of meal planning, nevertheless, occurs during grocery shopping, where decisions are made regarding the type of ingredients to be purchased rather than the type of preparations that will take place during the week or on weekends (Barbosa, 2007).

During the week, practicality, savings, and convenience are dominant characteristics of food menus in Brazilian households. During the weekends, however, families pay more attention to individual preferences and take more time to prepare meals. Saturdays and Sundays are characterised by a menu that is more elaborate and varied, special occasion meals include barbecues, desserts, pizzas, pasta, pastries, ice-creams, and soft drinks (De Barcellos, 2007).

Generally speaking, Brazilians like to cook from scratch using raw and unprepared ingredients produced primarily by small and mid-sized farmers. Nevertheless, modernization is unavoidably bringing an increase in sales of manufactured foods and fast-foods among households, particularly in the high income group. Despite this increase, consumers still consider these foods to be an alternative for "emergency" situations arising from unexpected changes in routines (Carlos et al., 2008).

Food portion sizes are also increasing among households and dietary patterns are changing. These changes reflect a reduction in the consumption of complex carbohydrates and an increase in the consumption of foods that are high in energy density, fats, and sugars (Souza and Hardt, 2002; IBGE, 2004; Fisberg et al., 2006; Claro et al., 2007; Carlos et al., 2008). Excessive fat intake is more obvious in urban cities and is mainly due to an increase in the consumption of animal products (meat and dairy) and vegetable oils and fats (soy oil and margarine) (IBGE, 2007).

Frozen processed foods and ready-to-eat meals are becoming more popular in Brazil although not all age groups are likely to consume them. For example, there is some indication that the elderly prefer to prepare their meals at home from fresh and traditional ingredients and take the time to enjoy their food (Lima-Filho et al., 2008).

Emerging trends in Brazil: Functional Foods

The functional food industry in Brazil had a growth rate of 11% in the period 2006 and 2007, with a market size estimated at over US\$ 6 billion (Euromonitor, 2007). There is much potential for growth, which is increased by an aging and more educated population, attentive to information about nutrition and health. For instance, sales of health and wellness food and beverages are expected to record a good performance in the 2009-2014 period driven by better economic indicators, such as low unemployment, low inflation and higher disposable income. It is expected that improvement in purchasing power amongst the middle classes will also have a major impact on the performance of better for you, naturally healthy and fortified/functional products in the near future as the penetration of these kinds of products is currently still low among lower-income demographics (Euromonitor, 2010).

Beverages are one the most popular sectors in functional/fortified products in Brazil. They have a convenient format which can be consumed on the move, and therefore tap into key consumer demand patterns of health, convenience and portability. The sector is furthermore led by major drinks multinationals PepsiCo and The Coca-Cola Company, which are able to invest considerably in the development, marketing and distribution of these products. The top ten leading players are comprised mainly of multinational manufacturers such as Dairy Partners Americas Brasil, Coca-Cola Indústrias, Cadbury Adams Brasil, Danone and Kraft Foods Brasil. Due to fierce competition in standard products and growing interest among consumers for healthier food and beverage alternatives, these companies saw the opportunity to invest in value-added products. (Euromonitor, 2010).

Supermarkets/hypermarkets accounted for the bulk of sales of health and wellness food and beverages. Large retailers have been investing in health and wellness private labels. For instance, Grupo Pão de Açúcar released its Taeq brand in 2006, Carrefour launched Viver in 2007 and Wal-Mart released Sentir Bem in 2009. These private label are available in a wide assortment of products that include light, diet, soy-based products, organic and fortified/functional food and beverages (Euromonitor, 2010). Nevertheless, healthy specialist stores have slowly gained share over grocery stores in the review period. This latter channel saw an opportunity to sell products and brands that are usually not available in grocery stores such as food intolerance and organics and there are many health specialist stores opening mainly in urban centres.

Yet, data on Brazilian consumer behaviour toward functional foods is scarce, which presents a great opportunity for us to investigate this issue. It is clear that consumers living in urban areas, with more exposure to media and information channels, are becoming increasingly aware of the health impacts of the diet as a whole and particularly about certain food products. Some studies also show that the Brazilian mature and elderly population, with higher levels of education and access to information, tend to make the connections between a healthy diet and disease prevention more often than other age groups. They characterise healthy eating as a variety of fruits, vegetables, grains and lean meats, while reducing consumption of fatty, deep-fried and sugary foods (Lima-Filho et al., 2008).

Communication strategies are very important in the promotion of functional foods in Brazil since the population shows a lack of understanding and knowledge in this area, especially regarding health claims. For example, a recent study conducted in Rio de Janeiro showed that consumers were confused about the role and health benefits of probiotic foods (Viana et al., 2008).

Brazil is the only country in Latin America that has a well-defined regulatory framework for functional foods and health claims. ANVISA Brazil agrees that safety is a priority and should be based on risk analysis (Lajolo, 2002). Some of the functional foods with approved health claims in Brazil are spreads with phytosterols, milk containing omega-3 fatty acids, milk with prebiotics, and probiotic products.

4.2 Functional Products available at large retail chains in Porto Alegre

Answering one of our objectives, Table 3 reveals a selection of functional food/enriched/fortified products available at the retail market in South Brazil.

Table 3. Functional/Enriched/Fortified products available at large retail chains in Porto Alegre.

Category/ Food Product	Benefit	Brand/Company (status*)
Dairy Products		
Cheese (Minas Frescal)	Gut health - Probiotics (<i>Bifidobacterium lactis</i>)	SanBios/Santa Clara (L)
Cheese (Petit suisse) Strawberry	Antioxidants, Bone health (zinc, protein, iron, vitamins, calcium)	Danoninho/ Danone (MN) Batavinho/ Batavo (LO) Vigorzinho/ Vigor (LO) Piazinho/ Piá (LO)
Fermented milk (natural, fruits, frozen)	Gut health - Probiotics (<i>Bifidobacterium animalis</i> / Danregularis/ <i>L casei</i> defensis)	Activia/ Danone (MN)
Fermented milk	Gut health - Probiotics (<i>L casei shirota</i> , <i>L paracasei</i> , <i>Bifidobacterium animalis</i>), Antioxidants (zinc, vitamins A, C, D, E), Bone health (calcium)	Yakult/Yakult (MN) Ninho soleil/ Bliss/Chamyto/Nestlé (MN) Corpus Vitacal/Activia/ Danone (MN) Batavito/ Bob Esponja/Batavo (LO)
Skimmed yogurt (natural, fruits)	Heart health (Plant sterols)	Pro-activ Becel/Unilever (MN)
Whole/Semi-skimmed yogurt (fruits)	Gut health - Probiotics (<i>Lactobacilos acidophilus</i> and <i>Bifidobacterium lactis</i>)	Biofibras/ Batavo (LO)
Yogurt (natural, fruits)	Antioxidants, Bone health (calcium, vitamins A and D)	Plena/Piá Gurt / Piá (LO)
Yogurt	Gut health - Probiotics (<i>Lactobacilos acidophilus</i> and <i>Bifidobacterium lactis</i>)	Piá Essence/ Piá (LO)
Milk drink	Antioxidants, Bone health (calcium, iron, magnesium, activen E (vitamins and salts)	Nescau/ Neston/Nestlé (MN)
Enriched UHT Milk (skimmed, semi-skimmed, whole)	Antioxidants, Bone health (calcium, vitamins A, C, D, iron, collagen)	Elegê/ BR Foods (LO) Batavo/BR Foods (LO) Molico/ Nestlé (MN) Ninho soleil/ Nestlé (MN)
Products with Soy		
Soy drink/ Soy yogurt	Antioxidants, Bone health (calcium, soy protein, vitamins B, C, D, E)	Nutrikids/Ades/Ades (MN) Mais Vita/ Yoki (LO) Soy/ Olvebra (LO) Nutrisoja/Naturis/ Batavo (LO) Sollys/Ninho Soleil/Nestlé (MN)
Green tea with soy	Antioxidants, Bone health (calcium, vitamins C and D)	Soy Tea/ Olvebra (LO)
Spreads		
Margarine	Heart health, Antioxidants (omega-3 and 6, folic acid, vitamins A, B, D and E)	Doriana/ Gessy Lever (MN) Delícia/Cyclus/ Bunge (LO) Qualyvita/ Sadia (LO) Becel Original/ Unilever (MN)
Margarine	Heart health (Plant sterols)	Pro-Active/Becel (MN)
Cereals		
Bread (multi-grain, rye-bread)	Hearth and gut health, Antioxidants (fibre, protein (collagen), omegas-3 and 6, vitamins B, C and E, iron, zinc)	Multigrain/Benefice/Seven Boys (LO) Vitta Natural/ Nutrella (LO) Roggenbrat/ Lizamenbrot/ Nutrella Bread's/Bread's (LO)
Pasta	Isoflavone (soya and calcium)	Activita/ Adria (LO)
Rice	Gut health, antioxidants (Fibre, iron, protein, vitamins)	Ritto/ Mãe Terra (LO) Ráris/ Mars (LO) + Vita Tio João/Josapar (LO)
Corn flakes	Antioxidants (iron, calcium, zinc, vitamins B, C, pantotenic acid, niacin and phosphorus)	Snow Flakes/ Gold Mel/ Moça Flakes/ Nescau/ Corn Flakes/ Nestlé (MN)
Cereal Bar	Antioxidants, Energy (with Açai berry and guarana)	Ritter Light/Ritter (LO)
Drinks		
Energy drinks	Brain health - mood (taurine, caffeine)	Red Bull (MN) Burn/Coca-Cola (MN) Monster energy (MN) All Need (LO)

*status is defined as LO if the company's capital is local (Brazilian) and MN if the company is a multinational

In accordance with preliminary secondary data presented, dairy products constitute the biggest category available in the shelves. From UHT milk to a variety of yogurts and fermented milks, consumers from South Brazil find different options, supplied either by traditional multinationals (such as Danone Activia and Yakult) or by local industries (such as Piá and Santa Clara). One interesting example of innovative yogurt with probiotics produced by a local industry is Piá Essence. The brand offers traditional (such as strawberry and natural) as well as unique flavors, as tea essence flavored products (Passion Fruit with Chamomile, Red Grape with Sage and Strawberry with Green Tea). The company is succeeding in competing with the big players.

Cereals and bakery also indicate a significant presence of local companies developing innovative functional food products. For instance Seven Boys launched the brand Benefice (bread loaf) with collagen, targeting middle age females. Josapar extended its traditional rice brand Tio João to Tio João + Vita, adding vitamins to the product. Even at the energy drink category, usually dominated by multinationals, the presence of local food industry is now seen.

4.3 Results from Functional Food Consumer survey in Porto Alegre

In this section we present the results from the consumer survey held in Porto Alegre, South Brazil. First, the socio-demographic profile of the sample is presented, followed by their habits, motivations and attitudes towards functional foods. Finally, participants' opinions about four local functional food products are presented.

Demographic profile of the sample

Table 4 presented the demographic profile of the sample. The sample is predominantly feminine (68.2%), corresponding to 307 of the 450 interviewed individuals. Men therefore represent 31.8% of the total. In terms of age, most respondents are adults from 25 to 64 year old, being 43.8% between 25 and 44 years and 34% between 45 and 64 years old. The smallest group was composed by respondents above 65 years old (9.1%) and younger than 24 years old constituted 13.1% of the sample. Respondents with secondary completed education represented 38.7% of the sample, followed by 33.6% of individuals with superior education (university degree). Respondents with primary school were 11.8% and a minority had technical education (6.4%). Respondents with post-graduate degree are nearly 10% of the total.

The question about household situation helped us understand their familiar structure. 23.8% of the sample lives with its spouse/husband while 16.4% live with their parents. 14.7% live alone and 9.8% live with their sons/daughters. 7.3% live with their spouse and kids. Only 3.1% live with friends, indicating a predominantly familiar structure. In terms of number of people living at the residence respondents indicated households with 2 to 4 residents in 76.4% of the cases, in which 29.3% have only 2 persons. These results indicate small family units. Such information, combined with monthly household income next presented reinforces the indicative of high per capita income and consequent high purchasing power. People living alone represent significant 14.9% of the sample, and respondents living with 5 or more people are only 8.7%. Finally, with an almost egalitarian division, household income between US\$ 1.750 and US\$ 3.000 and above US\$ 3.000 are respectively 29.8% and 24.9% of the sample, indicating that more than 50% of the sample have economic conditions to buy food products with added value. However, most of respondents still have a declared income between US\$ 600 and 1.750 (38.4% do total). The lowest grade (up to US\$ 600) was declared by only 6.9% of the sample.

Table 4. Distribution frequency of the socio-demographic profile and number of respondents interviewed. Within each category the mode has been bolded.

Variable	Categories	Frequency (%)	Number (n)
Gender			
	Female	68,2	307
	Male	31,8	143
	Total	100,0	450
Age			
	25-44 years old	43,8	197
	45-64 years old	34,0	153
	Less than 24 years old	13,1	59
	More than 65 years old	9,1	41
	Total	100,0	450
Highest Education Attained			
	Secondary (High school)	38,7	174
	Superior (University degree)	33,6	151
	Primary (Basic education)	11,8	53
	Post-Graduate Degree	9,6	43
	Certificate Program (Technical)	6,4	29
	Total	100,0	450
Household situation			
	Other	24,9	112
	I live with my partner, spouse	23,8	107
	I live with one/both of my parents	16,4	74
	I live alone	14,7	66
	I live with my son/daughter	9,8	44
	I live with a friend	3,1	14
	Other (Spouse and kids)	7,3	33
	Total	100,0	450
Number of people living at your residence			
	2	29,3	132
	3	25,3	114
	4	21,8	98
	1	14,9	67
	5	5,6	25
	More than 5	3,1	14
	Total	100,0	450
Monthly household income			
	From US\$ 600 to US\$ 1.750	38,4	173
	From US\$ 1.750 to US\$ 3.000	29,8	134
	More than US\$ 3.000	24,9	112
	Less than US\$ 600	6,9	31
	Total	100	450

Frequency of consumption and motivations to consume

The first question the interviewed individuals answered refers to the frequency they consume functional food. Table 5 presents the results.

Table 5. Frequency of consumption of functional food in Porto Alegre.

	Frequency (%)	Number (n)
Daily	64,4	290
Weekly	27,1	122
Fortnightly	4,9	22
Once a month	2,7	12
Rarely	0,9	4
Total	100,0	450

Frequency of consumption is very high, since 64.4% of the 450 respondents indicated to consume this food category on a daily basis, while 27.1% consume it weekly. Together, both groups represent 91.5% of the sample, indicating familiarity and penetration of functional food in the households of consumers from South Brazil. Based on this data, it is important to identify their main motivations to consume, as indicated in the following table.

Table 6. Motivations to consume functional foods from consumers in Porto Alegre.

	Mean	S.D.
To help in the maintenance of a healthy gut function	4,15	0,91
To keep a healthy lifestyle	4,13	0,90
To increase the wellness	4,06	0,87
To enhance the physical and mental performance	4,03	0,92
To help cholesterol reduction / prevent heart diseases	3,95	1,04
To prevent diseases (in the individual or in the family)	3,90	0,99
Habit or tradition	3,87	0,94
To improve physical appearance	3,81	0,99
To control appetite and body weight	3,65	1,05

To help in the maintenance of a healthy gut function was the most cited motive, followed by general health and wellness motivations, indicating that consumers from South Brazil are expecting to find these benefits through healthy eating – a good news to functional food industry. To enhance the physical and mental performance were also mentioned, indicating good opportunities in the development of mood food, not only through energy drinks. Motivations to reduce cholesterol and prevent diseases were also indicated, although with lower means. Motivation by habit/tradition was less cited together with the reason to improve physical appearance and to control appetite and body weight.

In fact, these results are aligned with the findings from retail, since probiotics and fibre are the most common categories available. Communication strategies from multinationals are also responsible for the popularity of probiotics: Benefits to gut health from Activia, Danone were massively informed to consumers by propaganda (tv, magazines, newspapers) and at sale points, contributing to consumer information and stimulating their consumption. In addition, Brazilian market (different from the Japanese, for instance) have very few functional food options aiming at the beauty function and potential weight control. Fibres, in this regard, are commonly used aiming at the good functioning of the intestines, and not as much claimed as weight control and sense of satiety.

Attitudes towards functional foods

Table 7 presents the obtained results of attitudes towards functional food from consumers in Porto Alegre, South Brazil.

Table 7. Attitudes towards functional foods from respondents in Porto Alegre.

	Mean	S.D.
The benefits promoted by functional foods are real	5,65	1,38
Functional foods make it easier to follow a healthy lifestyle	5,63	1,30
The growing number of functional foods on the market is a positive trend for the future	5,6	1,32
Even for a healthy person, the consumption of functional food is necessary	5,55	1,33
The idea that I can take care of my health by eating functional foods gives me pleasure.	5,48	1,42
Functional foods are absolutely necessary	5,48	1,35
My performance improves when I eat functional foods	5,45	1,33
I can prevent disease by eating functional foods regularly	5,44	1,33
Functional foods promote wellness	5,43	1,30
The functional foods benefits of to health are clear	5,42	1,28
It is great that modern technology allows the development of functional foods	5,37	1,32
I believe that functional foods fulfil their promises	5,36	1,31
Functional foods can repair the damage caused by an unhealthy diet	5,30	1,45
The safety of functional foods has been very thoroughly studied	5,28	1,33
The consumption of functional foods is completely safe	5,28	1,31
It is important to add benefits (as vitamins, probiotics, omega-3) to otherwise unhealthy food	5,10	1,39
Not enough information is being given about the benefits of functional foods	5,04	1,42
Functional foods are high-technology products	5,03	1,39
Functional foods help to improve my mood	5,02	1,514
I am prepared to compromise on the taste of a food if the product is functional	4,80	1,71
I prefer to eat foods with medicine-like effects	4,75	1,50
I actively seek out information about functional foods	4,73	1,68
Functional foods are consumed mostly by people who have real need for them	4,57	1,71
Even if If used in excess, functional foods can not be harmful to health	4,22	1,91

Overall, results indicate a positive attitude towards functional foods from individuals interviewed in Porto Alegre (most answers with means above 5.0 on a 7-point scale). Items with higher means were associated to health and wellness provided by functional foods. These one, besides being the main motivations are particularly important to women, as indicated by previous studies. (Bech-Larsen; Scholderer, 2007; Frewer et al., 2003). Since in this survey women are the majority, such result is somehow confirmed.

In order to analyse the structure of attitudes and to reduce observable variables them into latent ones – factors - an exploratory factor analysis (EFA) was applied. A Principal Component Analysis (PCA) with Varimax Rotation Method was performed and the obtained matrix and respective factor loadings are presented in the following table.

Table 8. Exploratory Factor Analysis of the Attitudes towards Functional Food in South Brazil: Factors and Loadings.

Factors	1	2	3
	Reward (FF Rew)	Trust (FF Tru)	Medical (FF Med)
The idea that I can take care of my health by eating functional foods gives me pleasure.	0,831		
Functional foods are absolutely necessary	0,830		
Functional foods make it easier to follow a healthy lifestyle	0,828		
I can prevent disease by eating functional foods regularly	0,812		
The benefits promoted by functional foods are real	0,804		
My performance improves when I eat functional foods	0,78		
The growing number of functional foods on the market is a positive trend for the future	0,769		
Even for a healthy person, the consumption of functional food is necessary	0,754		
Functional foods can repair the damage caused by an unhealthy diet	0,685		
Functional foods help to improve my mood	0,677		
The safety of functional foods has been very thoroughly studied		0,778	
The consumption of functional foods is completely safe		0,768	
I believe that functional foods fulfil their promises		0,746	
It is important to add benefits (as vitamins, probiotics, omega-3) to otherwise unhealthy food		0,733	
The functional foods benefits of to health are clear		0,704	
It is great that modern technology allows the development of functional foods		0,703	
Functional foods are high-technology products		0,695	
Functional foods promote my welfare		0,694	
Not enough information is being given about the benefits of functional foods		0,605	
Functional foods are consumed mostly by people who have real need for them			0,766
Even if If used in excess, functional foods can not be harmful to health			0,762
I am prepared to compromise on the taste of a food if the product is functional			0,698
I actively seek out information about functional foods			0,673
I prefer to eat foods with medicine-like effects			0,549
Reliability of the attitudes' factors (Cronbach'a alpha)	0,958	0,938	0,824

As indicated in the rotated matrix, three factors were generated, which explain 70.85% of the phenomenon. Besides the clear dense factor loadings (a factor loading is the correlation between a variable and a factor that has been extracted from the data, and loadings above 0.4 are good indicators of this fit), the Kaiser-Meyer-Olkin (KMO) and Bartlett's test indicated significant results in 0.961 ($p = 0.000$). The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed. The Bartlett's test of sphericity is significant at $p=0.000$ indicating that the correlation matrix is not an identity matrix. Reliability was tested using Cronbach's alpha measures and we can say that the obtained factors are reliable, since the alphas were higher than 0.8, a highly satisfactory result.

Our results are somehow similar to those found by Urala and Lähteenmäki in 2004 and 2007, which identified four attitude factors towards functional foods in the 2004 study (reward from using functional food - FF Rew, confidence in functional food - FF Con, necessity for functional food – FF Nec, and functional food as medicine FF Med) and four factors in 2007 (reward from using

functional food - FF Rew, confidence in functional food - FF Con, necessity for functional food- FF Nec and safety of functional foods FF Saf).

In our case, we found three factors in a particular combination. Factor 1 “reward from using functional food” (FF Rew) is the strongest, linked to the benefits of wellness and health coming from functional foods consumption, as found in the original studies. Factor 2, named “trust in functional foods” (FF Tru) combines items reflecting consumers’ confidence and safety in functional foods, both in its function and in relation to risk of use. Aspects related to technology are gathered in this factor. Finally, factor 3 “functional food as medicine” (FF Med) would be equivalent to the original factor found by the authors in 2004 combined with the “necessity” factor, indicating that in this case, consumers choose functional foods mainly due to their medicinal benefits. One possible explanation for the unification of these concepts into three factors in relation to the original study may be the incipient stage of market development in South. Although familiar to some product categories (such as probiotics, as described earlier), consumers may not properly discriminate between the factors and technical aspects related to the product. Brazilian regulation body ANVISA in regard to functional food labeling is quite strict, and the use of claims is not potentially used as it would be desirable, in order to stimulate consumer’s information about the benefits of available products.

In terms of statistical difference between groups, they were not found between gender, indicating similar positive attitudes between females and males. However, significant differences were found in regard to respondents’ age. Consumers above 65 years old have more positive attitudes (5.9) in reward from using functional foods, if compared to the younger group (less than 24 years old) (mean 5.19). The same is true for functional food as medicine, with the mean from older group being 5.1 and from the younger 4.01. The physiological health of the youngsters and their lower disease expectation might explain such differences.

Trust in stakeholders

The next question was related to respondents’ confidence on the different innovation system agents related to functional food. Respondents should indicate their degree on a 7-point scale, ranging from Do not trust at all=1 to Completely trust=7. Table 9 presents results through their respective mean and standard deviation.

Table 9. Confidence on the different innovation system agents related to functional foods.

	Mean	S.D.
Dieticians/nutritionists	5,62	1,16
Medical professionals	5,49	1,13
Scientists	5,41	1,17
National health authorities (Ministry/Secretary of Health, ANVISA)	5,19	1,19
Information from the media (e.g. national tv shows, others)	4,90	1,25
Retailers	4,78	1,26
Medicine manufacturers/companies	4,76	1,52
Food manufacturers	4,67	1,46

Based on a 7-point scale

Confidence in dieticians/nutritionists and professionals from the medical area is higher, followed by scientists and national health authorities. For instance, health professionals can promote positive attitudes about functional foods by providing information about the benefits of these products. Uptake of functional foods may also be encouraged by distributing messages of approval from important groups, such family doctors and personal dieticians. For example, communication with

the public about these health products could include messages of endorsement from representatives of medical practitioners or from groups perceived to be peers (O'Connor and White, 2010).

Media, retailers and private companies (medicine and food sector) had the lowest confidence rate. This could be explained by consumers' perception of these agents' commercial interest, consequently affecting their credibility. Such results indicate the need for articulation and governance from the agents of the innovation system for functional food in Brazil, aiming to establish a common denominator on the benefice. Even though industry and retailers are the main figures in functional food product development, they are the least trusted agents.

Perception about real functional food products produced by local industries

In this next section, we explore respondents' perception about four real functional food products produced by local industries (South Brazil). First, we investigated familiarity with the products in a 5-point scale, as suggested by Urala and Lahteenmaki (2004).

Table 10. Familiarity (previous use) of selected functional foods.

	Benefice Bread (Seven Boys)	Piá Essence (Piá)	All Need Energy Drink (All Need)	SupraSoy (Josapar)
I do not recognise this product	43,1	25,3	76,2	65,6
I recognise the type of products, but I have never tasted any.	30,0	34,9	14,0	24,4
I have tasted but I do not use this product.	7,1	11,1	3,8	5,1
I use these products occasionally.	14,4	23,6	4,9	2,9
I use these products regularly.	5,3	5,1	0,9	2,0

Overall, results indicate that consumers recognize the selected products (especially the yogurt and bread), although regular consumption of the brands is limited.

When presented to the bread with antioxidants Benefice, 43% of respondents (194 consumers) said they did not recognize the product, while another 30% recognized, but claimed never to have tasted it. 19.7% of the individuals are alleged consumers of this product, with 5.3% consuming it regularly. 7.1 have tasted it but do not buy it, instigating further research to find the reasons why.

The yogurt with probiotics Piá Essence repeated the trend of Benefit bread, with only 5.1% regular users. However the degree of recognition by the respondents was higher: 34.9% indicating they already knew it, although they have never proved it. Promotional strategies at the point of sale could be positive in this regard. Of consumers who tasted - which totals 39.8% of the sample - 11.1% failed to keep eating the food and 23.6% use it occasionally.

The energy drink All Need is practically unknown by consumers, probably due to the fact that is not available in large retail chains, but rather in smaller shops in Porto Alegre. Other energy drinks from multinationals such as Red Bull, highly massified and advertised by the media, would show a very different picture.

Finally, SupraSoy from Josapar presents the same pattern, being unknown by 65.6% of the sample although being available at large retail stores. Only 2% of the interviewed consumers consume it regularly. Results suggest two main explanations: first, there is not enough promotion and second,

the brand is not among the choices for dairy products with soy. It is important to state that the product is available in powder (to be mixed with water) and its location in the supermarket is different from other soy drinks, ready-to-drink options. So the product might be attracting a different kind of consumers, perhaps more specific and not worried so much about convenience.

Finally, consumer perceptions about the appearance, benefice, healthiness and willingness to buy the four selected products are shown on Table 10.

Table 11. Consumers’ perception toward local functional food products characteristics: appearance, benefice, healthiness and willingness to buy.

	Benefice Bread (Seven Boys)		Piá Essence (Piá)		All Need Energy Drink (All Need)		SupraSoy (Josapar)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Appealing	5,28	1,67	5,15	1,80	3,00	2,09	3,66	2,19
Beneficial	5,42	1,60	5,13	1,86	2,83	2,03	4,11	2,19
Healthy	5,51	1,52	5,34	1,68	2,77	1,92	4,51	2,08
Willingness to buy	5,06	1,84	4,84	2,08	2,64	2,08	3,23	2,19

In terms of attractiveness, benefits, healthiness and willingness to buy, again the bread with antioxidants Benefice and yogurt with probiotics Piá Essence are highly desired by respondents. In case of the product SupraSoy (heart health category) perception is not that positive, but high standard deviations indicate a significant dispersion in the sample. Future analysis will investigate this issue. Although recognized as beneficial and healthy (lower means if compared to Benefice Bread and Piá Essence), SupraSoy was perceived as less appealing and the willingness to buy was found to be negative (below the median point, 3.5).

An exception is the category energy drink, in this research represented by All Need brand. The totality of obtained means was below average, indicating a negative attitude towards the product. Although standard deviations are also high, signaling a disperse sample, the product is considered unhealthy and unappealing, not being beneficial and with negative willingness to buy. Possible reasons are related to its consumption habits in Brazil, since the product is usually associated to alcoholic beverages such as vodka and whisky in a mix with ice, traditionally consumed at night clubs by youngsters.

When crossing results by gender, interesting results are displayed. For instance, for the bread and yogurt, female perceptions are statistically more positive in terms of attractiveness, benefice and healthiness. Women are also more willing to buy Benefice and Piá Essence. As oppose to that, women rejection to the energy drink All Need was statistically different to men, with their means being lower in all perception items. No gender differences were found in regard to SupraSoy.

In terms of age, results were also meaningful. Younger (below 24 years old) and older consumers (above 65 years old) find Benefice bread more beneficial than other age groups, signaling an interesting market opportunity to Seven Boys. Older consumers also find SupraSoy statistically more appealing than younger groups, as expected, due to its medical properties (cholesterol reduction, usually higher in older consumers). Finally, large statistical differences were found when analyzing perception towards the energy drink All Need. Young consumers are slightly positive towards the product (all averages close to 3.5 on a 7-point scale), whilst the older consumers are absolutely negative towards it (means ranging from 1.46 to 1.80). These results are in agreement

with published data. Differences in functional food acceptance with age have been reported by Childs (1997), IFIC (1999) and Poulsen (1999). These authors reported that older consumers have been identified as more likely to adopt functional foods in their diets.

5 Conclusions

In general, the scenario for functional foods in Brazil is highly positive. The functional food industry in Brazil had a growth rate of 11% in the period 2006 and 2007, with a market size estimated at over US\$ 6 billion (Euromonitor, 2007). There is much potential for growth, which is increased by an aging and more educated population, attentive to information about nutrition and health. For instance, sales of health and wellness food and beverages are expected to record a good performance in the 2009-2014 period driven by better economic indicators, such as low unemployment, low inflation and higher disposable income.

Our survey shows predisposition to consume and generally positive attitudes towards functional foods. Brazilian population is getting older and their concerns about health are growing accordingly, as indicated by previous studies (Frewer, 2003). The cultural diversity in Brazil is a passport to innovation and people in Brazil are becoming less passive, more educated, and are showing a higher demand for quality food products.

The innovation system is developing, although stronger governance and co-ordination strategies are needed. Regulation bodies in Brazil are quite demanding in terms of nutritional labelling information (Coitinho et al., 2002), what is somehow shown through respondents high confidence degree. Health professionals are also considered a trusted source whenever talking about functional foods, and their credibility could be better used by the functional food industry. Nutritionists and other professionals could help inform consumers about the benefits of particular categories of functional foods, since food industry itself is not regarded as the most trustworthy source. Considering the Brazilian context of system fragmentation, this question brings back the necessity of articulation between the different agents.

Specifically in regards to our survey results, the sample was predominantly composed by women, which according to secondary data, are the main responsible for the purchase of food in the households. Results from this research are therefore effectively characterizing the target-public aimed by the food companies. Interviewed consumers presented positive attitudes towards functional foods and enough purchasing power to buy it. Accordingly, frequency of consumption was generally high, with 64.4% of the sample indicating to consume generic functional food on a daily basis. Yet, frequent consumption of selected products produced by local food industries in South Brazil was very low. One explanation might be the lack of communication strategies and promotional actions, in a way that consumers are able to recognize the brand and identify its beneficial, if compared to conventional products (from the same company) or functional food products produced by multinationals (such as Red Bull and Danone Activia).

Finally, surveys aiming to characterize Brazilian consumers are fundamental to help food companies to define their strategies. To map the most accepted categories is also important to avoid the "tentative and error" approach. A good example is related to obtained results from energy drinks coming from our survey. One of the main motivations to consume functional food is to enhance the physical and mental performance, but apparently few products are exploring other carriers to provide such benefits. Brazil has a rich biodiversity, especially in plants, and native energetic

compounds and superfruits such as mate, guarana and açai berry could be better utilized in new product development process of functional food products.

As suggested by Urala and Lähteenmaki (2007), regular attitude monitoring is needed to see how the attitudes towards functional foods are developing in emerging markets as Brazil, as the products become more familiar. The structure of attitude scales becomes more stable with the correspondent familiarity of the products: once functional food products approach conventional foods, the scale tend stabilization.

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