Asian Journal of Agriculture and Food Sciences (ISSN: 2321 – 1571)
Volume 05 – Issue 02, April 2017

Characterization of Food Product Innovation Practices with Reference to Functional Food Product Development in Singapore

Rao Sanaullah Khan[1,*], Saw Lin Kiat[2] and John Mark Grigor[3]

[1] School of Food and Agricultural Sciences,
University of Management and Technology
(Lahore, Pakistan)

[2] Faesol Pte Ltd, Orchard Road, Singapore

[3] School of Science, Engineering & Technology,
Abertay University
(Dundee, United Kingdom)

[*]*Corresponding author's email: rao.sanaullah [AT] umt.edu.pk*

ABSTRACT— ***Functional foods, being one of the major food categories of the global health and wellness market, are becoming a major focus of new product development (NPD) in the food industry. The development of functional foods is more complex than traditional food New Product Development (NPD), calling for a concerted effort from researchers and NPD experts to explore and understand the functional food product development (FFPD) process in more detail. The current research in this field has reported that there is a need to evolve from a traditional NPD approach, towards an integrative and innovative approach involving cooperative networks and techniques of commercialization. However, there is little practical evidence on how much progress has been made to date. Therefore, this research was designed to investigate the food product innovation process of food manufacturing in the Asia-Pacific region (Singapore) with reference to functional foods development. Results report on a comparative account of NPD practices between registered Singapore food companies that are doing some sort of functional food development (Group 1) and those that are not (Group 2). A significant difference (P<0.05) in the aims and mode of NPD between Group 1 and Group was observed. Further it was observed that food companies in Group 1 have significantly (P<0.05) more diverse external collaborations with broad aims to collaborate, in comparison with food companies in Group 2. This is a positive step toward developing an external resource base, which is essential in developing functional foods. This attitude should be encouraged in future innovation polices as being critical to value-added food product innovations in Singapore. Apart from these differences, food companies are still pursuing a traditional NPD approach (independent and closed NPD); with loose Intellectual Property protection practices irrespective of type of innovation activity. There is a need to create awareness among the stakeholders about the factors needed for developing unique and inimitable resources, and dynamic capabilities in food manufacturing.***

Keywords— Food product innovations, Traditional NPD process characteristics, Functional food product development challenges.

---

1. INTRODUCTION

The food industry displays higher failure rates of new products than any other manufacturing industry, with some reports estimating a new product launch failure rate of more than 90% [2, 3]. One of the main reasons for such a high failure rate is the wide-spread reliance on 'me too' products. These products rarely last more than two years in the market. Conversely, truly innovative food products, which constitute less than 2% of all NPD launches, have been estimated to have a success rate of around 25% [3]. Most of the food companies have been reported to invest less than 2% on R&D from their budget. This policy is reflective of lower value to innovation and R&D activities in food manufacturing. Further the emergence of functional food products in the global health and wellness market has revitalise the importance of R&D activity and innovation output (Raymond, Mairesse, Mohnen, & Palm, 2015). Therefore, the importance of re-evaluating NPD processes, with the potential for improving return on investment and maintaining a competitive edge cannot be overemphasised. Functional foods (health oriented foods) provide the product developers with such an opportunity to innovate radically and be differentiated by the competitors [4] and [5]. Moreover functional food products are on high demand in global health and wellness market (Kraus, 2015) and these foods are now represents one of the fastest growing sector of food manufacturing as observed during the last couple of decades (Khan, Grigor,

Winger, & Win, 2013). A comprehensive review of traditional NPD practices and changing requirements of radical product innovation in the food industry led to a proposed better FFPD model (Rao et al. 2013). The main differentiating factors identified in this FFPD model were: orientation towards innovation, knowledge generation (analytical), development of resource base of a company (open innovation), collaborative networks and arrangements, and commercialization strategies. According to the resource-based view (RBV) of competitive advantage, resources and capabilities of a firm should be heterogeneous and inimitable to attain sustained competitive advantage (Barney, 1991; Margaret, 1993). These heterogeneous and inimitable resources can serve as a tool to implement differentiated strategies in order to obtain competitive advantage. Historically, the NPD process in the food industry has been a closed model, where all the NPD activities are conducted using company resources, and this has resulted in mostly incremental innovations. Among several reported drawbacks of this closed NPD, limited resources and spending on R&D are considered the most critical in the current scenario of competing on price and quality offering in supermarkets (Acosta, Coronado, & Romero, 2015). Also, easy access to technical innovations has made it critically important for food companies to rethink their NPD model from being an internally closed NPD model to a flexible interactive model. The other relevant changes required for FFPD is a focus on generating analytical knowledge instead of relying heavily on synthetic knowledge. This can be accomplished by developing the resource (technical know-how) base of the company by creating collaborative networks with diversified external partners (Khan, Grigor, Winger, & Win, 2013). This network approach is not only essential for product development but also for commercializing these innovative functional food products (Acosta, Coronado, & Romero, 2015). The main focus of these commercialization strategies should be to develop intellectual assets for a company which are essential in securing the premium returns on investment. Overall it can be said a more comprehensive and interactive nonlinear NPD model will suit the successful functional foods NPD.

Using this theoretical framework, product development processes and practices currently used by the food manufacturing industries to innovate in the functional food space in the Asia-Pacific region were investigated. This was partly achieved by differentiating companies based on their reported involvement in functional foods or not. Two groups were formed which facilitated a hypothesis driven approach comparing activities between these groups. The first exploratory study was carried out in New Zealand and reported in 2014 (Khan, Grigor, Win and Boland, 2014). A 22 % response rate determined that the food industry in New Zealand in general uses an orthodox (closed) approach to NPD regardless if it is carrying out functional food product development or not. Therefore, from an RBV perspective it is unlikely that any of the food businesses surveyed would gain a significant competitive advantage by adopting traditional approach towards functional food product development.

In this study we report on our survey of Singapore food businesses using the same survey tool as used in the New Zealand survey (Khan R. S., Grigor, Win, & Boland, 2014). Singapore was selected as an interesting market due to its positioning as an important Asia –Pacific trading hub whilst also having a well-established food manufacturing sector. Singapore being a city state without farms and limited primary production is dependent on substantial amounts of imported raw food materials (US$9.1 billion (2009/10)) with a focus on value added.

This research therefore aims to, empirically investigates the innovation processes of Singapore food manufacturing businesses with special emphasis on orientation towards innovation, collaborative networks and commercialisation techniques. The main hypotheses investigated were;

1. *H1: there is a difference in NPD orientation between companies manufacturing functional foods and other food companies.*
2. *H2: there is a difference in external collaborative links between companies manufacturing functional foods and other food companies*.
3. *H3: there is a difference in commercialization techniques between companies manufacturing functional foods and other food companies.*

2. METHODS

2.1. Questionnaire design and pre-test

A quantitative survey was designed based upon the ideas generated from previous surveys on innovations in New Zealand (Geoff 2010), UK (BIS 2005), OECD guidelines provided in the *Oslo Manual* for developing innovation related surveys [6] and a survey on new functional food product development in Canada (Canada 2003). Thus 32 semi-closed questions were compiled under four themes viz. ***NPD orientation,*** measured as a cumulative response as to the aim of

NPD (Li, Liu, and Zhao 2006), mode of NPD (Nystrom 1990) and orientation of organization towards innovations (OECD and Eurostat. 2005)***; cooperative network,*** measured as accumulative response to type of external partners and purpose of external collaborations (Emden, Calantone, and Droge 2006; Mishra and Shah 2009); ***commercialization techniques,*** measured as a response to tools for protection of innovation, marketing tools and marketing channels used (Mark-Herbert 2003; Ray 2004; Mark-Herbert 2004); and, ***drivers of and barriers to functional food product development*** was also explored. Respondents were asked to choose the factors which best describe their company practices. They could also add factors if their choice was not listed among the answer options. Colleagues in Singapore Polytechnic, ex-graduates of Massey University (Singapore), Spring Singapore, Food Innovation Resource Centre (FIRC), Singapore and Health Promotion Board (HPB) of Singapore piloted the questionnaire where a few changes were made.

2.2. Measures of the construct

2.2.1. Orientation towards innovation

It was measured by a set of three items response i.e., total number of new products developed during 2008-11, aims of these new products and mode of these new products development [7]. Finally a question on innovation characteristics of organisation was asked to choose from market/ product/process or organizational oriented innovations [6, 8, 9].

2.2.2. Cooperative network

It was measured by asking if company has any external links for NPD and who those partners are [10]. Finally what was the major purpose of these collaborations was measured through multiple choice answers.

2.2.3. *Commercialization technique and tools*

These were investigated by three items i.e., protection of innovation, marketing tools [11] and challenges to commercialization [12]. These items were explored by offering multiple choices.

The questionnaire was pre-tested with industrial contacts to ensure that survey was not too lengthy and complicated to impart unit non-response. All the terms used in this survey were defined and duration of interview was kept to 10-15minutes.

2.3. Ethics approval

Full Human Ethics approval from Massey University Human Ethics Committee [13] was obtained for overseas data collection in advance of commencement of data collection in Singapore.

2.4. Data Collection Plan

An online survey was developed using SurveyGizmo [14] tool for collecting data in Singapore.

2.4.1. Sampling Frame

A data base of Spring Singapore and FIRC was used to access the food manufacturing companies operating in Singapore (450 companies). The same inclusion and exclusion criteria were used as the New Zealand study [15].

2.5. Data collection

An email message from FIRC platform was sent to all the registered food manufacturing companies in Singapore where a link to complete the survey was embedded. Thus a total of 450 companies were contacted. These companies were given three weeks' time to respond. After that a reminder was sent to encourage further response. Finally a telephonic and email follow up was carried out with those participants who partially completed the survey to increase the completed responses. Thus a total of 54 companies (12%) completed the survey.

2.6. Data analysis

2.6.1. Descriptive statistics

Mean and average were calculated for all the parameters and used for further analysis. Two main statistical analysis methods i.e., Chi square and Mann-Whitney U test, were used. The details are presented in subsequent sections.

2.6.2. Chi Square Test

The questionnaire was designed to create two categories of responses: ***Group 1***: those who claimed to have functional food development activity in their company. ***Group 2***: those food companies who did not claim to have any functional food development activity in their company. This enabled a comparative analysis of NPD approaches adopted, nature of collaborative networks developed and commercialisation techniques used by these two group of companies. The main objectives of this analysis were to compare the innovation process of food manufacturing companies with regard to

functional food product development. Date collected on number new products developed in previous three years and mode of NPD conducted was subjected to Chi Square test (Table 2).

2.6.3. Mann-Whitney U Test

Ordinal Data was subjected to nonparametric test and Mann-Whitney U test was found to be the most appropriate for this analysis (Table 3, 4, and 5). GraphPad Prism 5 was used to perform a two tailed Mann-Whitney U test on sum of rank scores (with lower sum of rank scores indicating higher importance) at $P<0.05$ for finding significant difference in innovation characteristics of food companies belonging to ***Group 1*** and ***Group 2*** (Jolly and Therin 2007; Salavou and Lioukes 2003).

3. RESULTS

3.1. Demographics of food companies and participants

The employee size distribution of each of the two groups was more or less similar. The majority of the companies (77%) were in the range of 100-150 or below employees. The average numbers of new products launched by each company during 2009-2012 in the two groups were 14 and 21 respectively. As expected, the functional foods (FF) development average experience of participants in group 1 was higher (4 years) than group 2 (1 year).

One of the respondents in group 1 reported having launched more than 1000NPD in his career, which stands out to be an outlier in this small data set and this data point was thus omitted from the data set for calculating average NPD projects completed by each respondent. The average NPD value for this parameter was (3) lower in group 2 than group 1 (16) (Table 1).

Table 1. Salient features of sampled companies and respective participants

Characteristics	**Group 1 (companies manufacturing functional foods)** ***n=27***	**Group 2 (other food companies)** ***n=21***	**Overall** ***n=48***
1. Employee size distribution			
<20	10	6	16
20 or >20	6	7	13
101-150	4	4	8
151-200	2	1	3
>200	5	3	8
2. NPD statistics	**Number of new products**		
Average number of new products launched by each company (2008-11)	14	21	16.8
Average number of NPD projects completed by each respondent	16	3	9.9
Average FF experience (years) of each respondent	4 years	1 years	3.3years
3. Type of Ownership*	**Number of Food companies**		
National Companies	22	14	36
Multinational Companies	3	5	8

*Four of the respondents did not answer to this question.

3.2. Orientation towards NPD/innovations

3.2.1. Major aims of NPD

There was a significant difference (P<0.05) in the three aims of NPD (to increase range of goods and services, to increase responsiveness to consumers and to increase the knowledge sharing with consumers) between companies manufacturing functional foods and other food companies (Table 2). Food companies in group 1 directed a comparatively higher proportion of their NPD (32.34%) towards increasing their range of goods and services. It was further noted that other food companies (group 2) focus comparatively more of their NPD on increasing their responsiveness to consumers and increasing knowledge share with consumers.

3.2.2. Mode of NPD activities

There was a significant difference between Group 1 and Group 2 in their mode of NPD (Table 2). Group 2 companies were reported to have contracted out a higher number of NPD than those in Group 1, consequently resulting in a lower number of independent NPD done by food companies in group 2.

3.2.3. NPD/innovation characteristics

A lack of significant difference (P>0.05) in NPD/innovation characteristics (Table 2) indicates that there is no single orientation favoured for NPD of functional foods. These findings are in line with the New Zealand food industry response (Khan et al., 2013).

Table 2. Comparative New Product Development (NPD) approaches

Measures of the construct	Group 1 (companies manufacturing functional foods) *n=27*	Group 2 (other food companies) *n=21*	Chi Square Test
1. Major aims of NPD	***(No of NPD 2009-12)***	***(No of NPD 2009-12)***	
To increase range of goods and services	195 (32%)	115 (23.37%)	10.72, P<0.001*
To increase market share	138 (22.89%)	120 (24.39%)	0.34, P=0.55
To exploit new market opportunities	152 (25.21%)	97 (19.72%)	4.65, P<0.03
To increase responsiveness to consumers	15 (2.49%)	28 (5.69%)	7.37, P<0.006*
To reduce cost	88 (14.59%)	82 (16.67%)	0.88, P=0.006
To increase knowledge sharing with consumers	15 (2.49%)	50 (10.16%)	28.58,P<0.0001*
Total	**603**	**492**	
2. Mode of NPD activities	***(No of NPD 2009-11)***	***(No of NPD 2009-12)***	
Independent NPD	334 (88%)	305 (67%)	47.76, P<0.001*
Collaborative NPD	31 (8%)	40 (9%)	0.12, P=0.72
Contract out NPD	16 (4%)	108 (24%)	63.07, P<0.001*
Total	**381**	**453**	

*significant at P<0.05

Dominant innovation characteristics was asked to be ranked and there Mann-Whitney U test was applied on this particular parameter (Table 3). There was a non-significant difference (P<0.05) between two groups.

Table 3 Comparative orientation towards innovation

NPD/Innovation characteristics	Sum of Ranks & Mean			
	Group 1	**Group 2**	**Mann-Whitney U**	**P Value**
Market Oriented	593(23)	396(22)	225	0.83 (ns)
Product Oriented	627(23)	363(21)	210	0.62 (ns)
Process Oriented	493(21)	247(18)	142	0.43 (ns)
Organisational Oriented	506 (21)	274 (18)	154	0.44 (ns)

*Mean rank scores in parenthesis , ns: non-significant at P<0.05

3.3. Cooperative network

3.3.1. Types of external partners

The number of food companies with some sort of external collaboration was found to be higher in group 1 compared to group 2 companies. However, there was no difference between the two groups in regard to their external partner preferences (Table 4). These findings do not support that *H2: There is a difference in external collaborative links between companies manufacturing functional foods and other food companies*.

Table 4. Comparative collaborative NPD external partners for various related activities.

Measures of the construct	**Group 1 (companies manufacturing functional foods) n=27**	**Group 2 (other food companies) n=21**	**Statistics**	
			Chi Square	
Yes	18 (67%)	8 (38%)	3.90, P=0.049*	
No	9 (33%)	13 (62%)		
			Mann-Whitney U Test for ordinal data	
2. External collaborating partners				
	Sum of Ranks & (Mean)	Sum of Ranks & (Mean)	P value	Mann-Whitney U
Customers	197 (12)	34 (9)	0.38 (ns)	24
Ingredient suppliers	201 (12)	52 (10)	0.57 (ns)	37
Competitors	90 (8)	15 (8)	1.0 (ns)	11.50
University or Polytechnic	199 (12)	77 (13)	0.71 (ns)	45.50
Government research agencies	114 (8)	22 (11)	0.47 (ns)	9

*significant at P<0.05, ns: non-significant

3.4. Commercialization techniques

3.4.1. Protection of innovation/NPD

There was no difference between Group 1 and Group 2 for the various tools of protection used in NPD launch (Table 5.5). Hence the data do not support *H3: there is a difference in commercialization techniques between companies manufacturing functional foods and other food companies.*

3.4.2. Commercialization tools for NPD

There was no significant difference (P>0.05) between Group 1 and Group 2 in their commercialization tools for NPD (Table 5.5). These findings do not support *H3; there is a difference in commercialization tools.*

3.4.3. Barriers to commercialization of NPD

There was no significant difference (P>0.05) between Group 1 and Group 2 in their perception of various barriers to commercialization of NPD (Table 5.5). These findings do not support *H3; there is a difference in perception of barriers to commercialization.*

Table 5. Comparative commercialization techniques of food companies

Measures of the construct	Group 1 (companies manufacturing functional foods) *n=28*	Group 2 (other food companies) *n=21*	Mann-Whitney U Test	
Protection of innovation tools				
	Sums of ranks (Means)	**Sums of ranks (Means)**	**P Value**	**U Value**
Trade marks	361(17)	268(19)	0.57(ns)	130
Confidentiality agreements	474(20)	266(19)	0.85(ns)	161
IP contracts	313(16)	247(19)	0.33ns)	103
Patents	226(13)	209(17)	0.20(ns)	73
Copyrights	270(15)	195(16)	0.71(ns)	99
Commercialization tools for NPD				
Own marketing staff	620(24)	414(22)	0.57(ns)	224
Contract marketing staff	254(15)	180(15)	1.00(ns)	101
Electronic media	297(15)	298(21)	0.06(ns)	87
Brand ownership	384(19)	281(18)	0.64(ns)	145
Exhibitions	442(19)	299(20)	0.85(ns)	166
Trade shows	520(21)	341(21)	0.90(ns)	195
Barriers to commercialization				
Level of Govt. support	405(18)	297(20)	0.70(ns)	152
Legislation	419(19)	247(18)	0.70(ns)	142
Health awareness	469(20)	310(19)	0.79(ns)	174
Consumer confidence	495(20)	325(22)	0.62(ns)	170
Access to market	488(20)	291(19)	0.81(ns)	171

ns: Non-significant at P<0.05.

4. DISCUSSION

The comparative analysis of data between those companies claiming to manufacture functional foods (group 1) and this that claim no to (group 2) showed that the food industry in general operates on similar resources and capabilities irrespective of the potential type of innovation activity they may be undertaking (Table 2, 3, 4 and 5). From a resource-based view (RBV) of competitive advantage, it is unlikely that any of the food companies surveyed will gain a significant competitive edge in this environment (Barney, 1991). A traditional approach to NPD collaboration dominates the Singapore food manufacturing industry regardless of reported functional food new product launches or not. However, a promising trend with those businesses self-reporting functional food product launches was an increased external collaborative activity. Food businesses in Singapore, keen to engage in functional food NPD, need to strengthen these research linkages and generate protectable IP to build brands that can combat the supermarket-driven price wars. This can lead to the creation of heterogeneity in resources of these firms and hence they may develop capabilities to exploit these resources to implement differentiated innovation strategies. These external collaborations need to be further investigated in relation to innovation activities in the food industry. Also there is a need to identify resources for development of functional foods and capabilities that are valuable, rare and costly to imitate. These resources and capabilities are critical for attaining competitive advantage in the food manufacturing industry.

5. CONCLUSIONS

5.1. Conclusions and implications for research and practice

Functional food product development activities seem to have no effect in terms of the new product development strategy that is being adopted by food businesses.

A customer dominated NPD approach is prone to fall short of the mark in the wake of emerging health and wellness market segment which requires a change in NPD attitude where future needs and demands of consumers are to be met through understanding consumer attitudes towards foods and their life-style. However, this is a challenging task for food companies that are too small, to employ NPD professionals and resources to develop an interactive NPD model where internal capabilities are leveraged with external resources to enhance the innovative capability of food companies.

Singapore food manufacturing industry must adopt a NPD process which can cater the needs for discontinuous product innovations that will ensure higher return on investment while providing leading edge in global food market. In order to attain sustained competitive advantage in the global market, Singapore food manufacturing has to identify the factors of sustained competitive advantage. Heterogeneity in resources and capabilities are essential at national level of innovation system to create competitive behaviour among stakeholders. The prevalent scenario of homogenous resources and capabilities can be changed by facilitating the development of technological collaborations among the stakeholders at national level. Thus traditional dominance of customer oriented product innovations can be balanced out with novel product innovations. Hence a better chance of introducing value added functional food products. In relation to this change, there is a need to create awareness among the stakeholders about the factors of developing unique and inimitable resources, and dynamic capabilities in food manufacturing.

5.2. Limitations and future research

This study was exploratory in nature and the results presented are from a smaller industry size (Singapore). The responses were collected from a NPD personnel or similar person responsible for product development activities in each food company. Single response was collected against each item of the construct in this survey. Therefore propositions made in this article are cautiously offered. It is hoped that further studies will broaden the scope of these propositions. Also multiple responses from a single company about commercialization techniques can be sorted in future studies to ensure a comprehensive response.

This research was a first step towards understanding the characteristics of innovation process of food manufacturing industry in relation to value creation. Further investigation on variable factors of value creation should be explored in more depth by academia, government institutes and relevant industry exports to provide guidelines for food industry to develop differentiated policies of innovations.

6. ACKNOWLEDGEMENT

The Singapore study was conducted in collaboration with Singapore Polytechnic, Food Innovation Resource Centre (FIRC), Health Promotion Board (HPB) of Singapore. The research was funded by the Higher Education Commission of Pakistan and by the Riddet CoRE (Centre of Research Excellence) Platform 4.3 Future Foods programme.

7. REFERENCES

1. Acosta, M., Coronado, D., & Romero, C., "Linking public support, R&D, innovation and productivity: New evidence from the Spanish food industry", Food Policy, vol. 45, pp. 50-61, 2015.
2. Barska, A., & Wojciech, M., "Innovations of the food products from the perspective of the Gen Y consumers," Oeconomia, vol. 13, no.3, pp.17–27, 2014.
3. Bigliardi, B., & Galati, F., "Innovation trends in the food industry: The case of functional foods". Trends in food science and technology, vol. 31no. 2, pp.118-129.2013.
4. Bombaywala, M., & Riandita, A., "Stakeholders' collaboration on innovation in food industry", The 6th Indonesia International Conference on Innovation, Enterpreneurship and Small Business. Vol. 169, pp. 395-399. Indonesia: Elsevier Ltd. 2015, Retrieved 06 22, 2016.
5. BIS. *UK Innovation Survey*, [cited 2011; Available from: http://www.bis.gov.uk/assets/biscore/corporate/migratedd/publications/f/file9686.pdf.,2005.
6. Datta, A., Mukherjee, D., & Jessup, L., "Understanding commercialization of technological innovation: taking stock and moving forward', R&D management, vol. 45, no. 3, pp. 215-249, 2015.
7. Esbjerg, L., Burt, S., Pearse, H., & Glanz-Chanos, V., "Retailers and technology-driven innovation in the food sector", British Food Journal, vol. 118, no. 6, pp.1370-1383, 2016.
8. Hardy, N., "*Future innovations in food and drinks to 2015*, in *NPD, trend convergence and emerging growth opportunities",* Business Insights: London. pp. 152, 2005.
9. Herath, D., Cranfield, J., Henson, S., & Sparling, D., "Firm, market and regulatory factors influencing innovation and commercialisation in Canada's functional food and nutraceutical sector", Agribusiness, vol. 24, no. 2, pp. 207-230, 2008.
10. Khan, R. S., Grigor, J. V., Win, A. G., & Boland, M., " Differentiating aspects of product innovation process in the food industry", British Food Journal, vol. 116, no. 8, pp. 1346-1368, 2014.
11. Khan, R. S., Grigor, J., Winger, R., & Win, A., "Functional food product development-challenges and opportunities," Trends in Food Science and Technology, pp. 27-37, 2013.
12. Kim, B., & Kim, J., "Structural factors of NPD (new product development) team for manufacturability", International Journal of Project Management, pp.690-702, 2009.
13. Kohli, A.K. and J.J. Bernard, "*Market Orientation: the construct, research proposition, and managerial implications"*. Journal of Marketing, vol. 54, no. 2, pp. 1-18, 1990.
14. Kraus, A., "Development of functional food with the participation of the consumer. Motivators for consumption of functional products," International Journal of Consumer Studies, pp. 2-11, 2015.
15. Kuuliala, L., et al., "*Preparation and antimicrobial characterization of silver-containing packaging materials for meat"*. Food Packaging and Shelf Life, **6**: p. 53-60, 2015**.**
16. Lagorce, A., " *Functional foods bring healthy returns"* [cited 2010 06-05]; Available from: http://www.marketwatch.com/story/functional-foods-bring-healthy-returns-2009-12-09.
17. Li, Y., Y. Liu, and Y. Zhao, "*The role of market and entrepreneurship orientation and internal control in the new porduct development activties of Chinese firms"* Industrial Marketing Management, no. 35**,** pp. 336-347, 2006.
18. Mark-Herbert, C., "*Functional food for added value. Developing and marketing a new product category.*, in *Department of economics"*, Swedish University of Agricultural Sciences: Uppsala. pp. 168, 2002.
19. Mishra, A.A. and R. Shah, "*In union lies strength: Collaborative competence in new product development and its performance effects",* Journal of Operations Management, vol. 27 no. 4, pp. 324-338, 2009.
20. MUHEC, *Research Ethics*, 2013 [cited 2013; Available from: http://www.massey.ac.nz/massey/research/research-ethics/research-ethics_home.cfm.
21. OECD, *Oslo Manual, "Guidelines for collecting and interpreting of innovation data*," Organisation for Economic Cooperation and Development: Oslo, pp. 166, 2005.
22. Raymond, W., Mairesse, J., Mohnen, P., & Palm, F., "Dynamic models of R & D, innovation and productivity: Panel data evidence for Dutch and French manufacturing", European Economic Review, vol.78, pp. 285-306, 2015.
23. Ray, K., *A strategic analysis of new product entry into the nutraceuticals, functional foods, and vitamins and supplements market.*, in *Business Administration*, University of Victoria, 1992: Victoria. pp. 119, 2004.
24. Reid, M., & Brady, E., "Improving firm performance through NPD: The role of market orientation, NPD orientation and the NPD process", Austarlasian Marketing Journal, vol. 20 no. 4, pp. 235-241, 2012.
25. Revilla, A. J., & Fernández, Z., "The relation between firm size and R&D productivity in different technological regimes", Technovation, vol. 32 no. 11, pp. 609-623, 2012.
26. Siro, I., et al., *Functional food. Product development, marketing and consumer acceptance-A review.* Appetite, vol. 51, pp. 456-467, 2008.

27. SurveyGizmo. *PS_Build Mapping New Product,* [cited 2013; Available from: https://appv3.sgizmo.com/projects/overview?id=1173536, 2013
28. Younesi, E., & Ayseli, M. T., "An integrated systems-based model for substantiation of health claims in functional food development", Trends in food science and technology, vol. 41, pp. 95-100, 2015.
29. Ziggers, G.W., *Radical product innovation in the Dutch food industry.* Journal of Food Products Marketing, vol. 11 no**.** 3 pp. 43-65, 2005.