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Douglas Sorenson and Maeve Henchion

Teagasc, Ashtown Food Research Centre, Ashtown, Dublin 15, Ireland<sup>a</sup>



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# Consumers' Perceptions of Novel Process Technologies: The Case of High Pressure Processed Chilled Ready Meals

Douglas Sorenson<sup>a,1</sup> and Maeve Henchion<sup>a</sup>

Teagasc, Ashtown Food Research Centre, Ashtown, Dublin 15, Ireland<sup>a</sup>

**Abstract.** *Consumers' growing concerns with regard to the food supply chain continue to influence their perceptions of emerging novel food processes. The main objective of this study was to explore consumers' perceptions and potential purchase motivations for chilled ready meals produced using high pressure processing. In-depth one-to-one soft laddering interviews were conducted in-home with 40 purchasers of chilled ready meals, aged between 18 and 44 years, living in Dublin City and County, Ireland. The in-depth discussions explored a range of issues concerning consumers' acceptance of high pressure processing, as well as their preferences for high pressure processed chilled ready meal concepts. The results of the study showed that consumers were generally receptive towards high pressure processing of chilled ready meals. Subsequent discussions revealed where consumer acceptance issues could potentially arise concerning the application of high pressure processing to chilled ready meals. The soft laddering technique revealed distinct differences between consumer groups across consumption patterns and life stages with regard to their purchase preferences and potential purchase motivations. The insights generated from this research can assist companies design consumer-relevant communication strategies, which effectively differentiate high pressure processed chilled ready meal from incumbent products.*

**Keywords:** Means-end Chain, Consumer Acceptance, Novel Process Technologies.

## 1. Introduction

### 1.1. Radical innovations and the product development process

New product development (NPD) is essential to the success and future of companies as technologies, markets and consumers change. Added to this are higher levels of competition, and increasing pressure to reduce NPD lead times and product development costs<sup>[1, 2]</sup>. Indeed, time has become increasingly important for organisational competitiveness and profitability as a result of shorter product lifecycles<sup>[3]</sup>. Companies need to act quickly and accurately to identify consumers' needs, and develop new products in order to gain higher levels of consumer satisfaction<sup>[4]</sup>. Late entry to the market, as a consequence of a reactive approach to NPD, can result in low market share in new markets, or loss of market share in existing markets. In contrast, the early introduction of new products can facilitate long-term market dominance and help detract the entry of competitors into those markets<sup>[5]</sup>. Consequently, the successful management of the innovation function has been identified as a necessary ingredient for organisational competitiveness and an important growth factor for companies<sup>[6, 7]</sup>.

From an operational perspective, new food product development can best be viewed in terms of a product development continuum with incremental new product ideas such as line extensions at one end of the continuum and radically innovative new products at the other extreme<sup>[8]</sup>. Radically innovative new products offer potentially greater rewards to companies in terms of adding value and potentially higher premiums, and to consumers in terms of delivering superior value. However, radically innovative products are also believed to involve considerable risk in terms of new product failure, which can be attributed to latent or unarticulated consumer requirements<sup>[8, 9]</sup>. A non-linear relationship is believed to exist between product newness and consumer willingness to try novel products across two dimensions, product complexity and competitive advantage<sup>[10]</sup>. Although the degree of competitive advantage increases with increased product newness, it also increases the degree of complexity of novel products. From a consumer behaviour perspective, this in turn is believed to reduce consumer acceptance of novel products<sup>[10, 11]</sup>. More importantly, from a strategic marketing perspective, this is also believed to affect a company's ability to predict consumer acceptance of novel products<sup>[12]</sup>. Radical innovations have therefore come to represent the most rewarding but also the riskiest form of NPD activity.

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<sup>1</sup> Corresponding author. Tel.: +353-1-8059951; Fax: +353-1-8059550; Email: douglas.sorenson@teagasc.ie.

## 1.2. Consumers' perceptions of novel processes technologies

A growing body of consumer research suggests that consumers are more conscious of, and have growing concerns with regard to, the food supply chain, which have influenced and will continue to influence their perceptions of emerging novel food processes<sup>[13, 14]</sup>. In particular, a number of consumer studies have consistently shown that European consumers' have poor knowledge and awareness levels coupled with high levels of scepticism towards the most radical food process innovations such as genetic modification and food irradiation<sup>[15, 16, 17, 18, 19, 20, 21, 22]</sup>. More so, foods produced by these novel processes have generally been perceived as unsafe, unwholesome and unnatural by consumers<sup>[23, 24, 25, 26, 27, 28, 29]</sup>. Consequently, given that food production methods have become an increasing cause of concern, a greater proportion of consumers are increasingly seeking 'clean labelled' minimally processed food products such as artisan foods and organic foods<sup>[30, 31, 21]</sup>. A review of the empirical research suggests that the key factors influencing consumer acceptance of novel foods can be generally grouped as follows: the degree of consumer involvement and food/food technology neophobia<sup>[32]</sup>; trade-offs between perceived benefits and risks<sup>[15]</sup>; unforeseen risks and social and moral concerns in relation to long-term effects of novel technologies on human health<sup>[33, 34]</sup>; perceived threat to the food chain and the environment<sup>[26]</sup>; consumer characteristics such as cultural, psychosocial and lifestyle factors<sup>[35, 36]</sup>; the influence of the carrier and nature of the benefits on consumer acceptance<sup>[37]</sup>; product-oriented factors related to food choice and perceived food quality categorised into information search, product experience and credence dimensions of quality<sup>[38, 26]</sup>; and trust in key stakeholders<sup>[39, 26]</sup>. Although new technologies have the potential to deliver tangible benefits to consumers ranging from extended shelf life to improved nutritional and sensory profiles, these emerging technologies at the same time raise concerns amongst consumers<sup>[40, 41]</sup>.

Whilst the literature highlights consumers' negative attitudes towards novel food processes generally, there is increasing evidence to suggest that these negative sentiments do not extend to all emerging novel food processes. Specifically, recent studies that examined consumers' perceptions of novel processes across different technologies found that concerns varied dramatically with the greatest concern for the most radical innovations, namely genetic modification and food irradiation<sup>[42, 43, 44]</sup>. In contrast, consumers had a high degree of acceptance for a novel process technology called high pressure processing relative to more established technologies such as thermal processing and freeze-drying, and similar findings have been reported elsewhere<sup>[43, 45, 46, 47]</sup>. High pressure processing is a non-thermal processing technology that involves the application of hydrostatic pressure to inactivate microorganisms and extend the shelf life of foods with minimal effect on nutritional and sensory qualities<sup>[48]</sup>. To explain these findings it is suggested that emerging novel technological process such as high pressure processing are less well known, and importantly, less emotive than more radical process technologies such as food irradiation or genetic modification<sup>[42, 49, 50]</sup>. Consequently, as companies move along the continuum towards more radical innovations, consumers' fears and concerns appear to become accentuated with radical innovations scoring poorly on naturalness and healthiness dimensions in comparison to incremental innovations produced using more conventional technologies<sup>[35, 47]</sup>. In that sense, how can companies manage risk when exploring new product opportunities using novel process technologies?

## 1.3. Managing risk in the product development process

Product development is a knowledge intensive process where the generation of new ideas and concepts requires detailed knowledge of both products and consumers. Therefore, companies that effectively manage knowledge throughout the NPD process can create more evident values in their offerings in order to effectively meet consumers' needs. Consumer involvement in the early stages of the NPD process is considered a key factor for new product success given that consumers can make an effective contribution to new food product design<sup>[37, 51, 52]</sup>. This is particularly true for low involvement foods that consumers might have little experience of, such as foods produced using novel technologies, given that consumers may have difficulty not only in assessing perceived risks, but also perceiving benefits that may be psychosocial in nature<sup>[53]</sup>. In that sense, understanding consumers' beliefs and attitudes towards novel processes is critical in order to foresee consumer acceptance issues and to take these into consideration when developing novel products<sup>[54, 55, 21, 56]</sup>. The research presented in this paper formed part of a larger multi-disciplinary research project, and explored consumers' attitudes and perceptions towards novel process technologies, and applied it to the development of high pressure processed chilled ready meals.

## **2. Research objective and methodology**

### **2.1. Research objective**

The main objective of this study was to explore consumers' perceptions and potential purchase motivations for chilled ready meals produced using high pressure processing.

### **2.2. Research methodology**

Means-end chain theory is an extension of the notion that 'product meaning' not only encompasses tangible attributes but also abstract attributes, meanings and benefits that lead to personal value perspectives of importance to consumers<sup>[57, 58]</sup>. The laddering technique based on means-end chain theory is primarily concerned with gaining insights into consumers' buying and choice motives through the development of a hierarchical model referred to as a hierarchical value map. It is therefore considered an extremely valuable technique for providing insights into how product information is cognitively processed by consumers in order to identify the underlying reasons why specific product attributes and consequences are relevant to consumers' value systems<sup>[59]</sup>. Laddering data can be gathered through either a qualitative (soft) or quantitative (hard) iterative laddering process<sup>[60]</sup>. Soft laddering was chosen for this study based on consumers' low involvement with high pressure processed foods as well as the paucity of research on consumers' cognitions for such products. The semi-structured interview schedule covered three main research themes: purchase behaviour and consumption habits for chilled ready meals; general attitudes towards chilled ready meals; and consumers' attitudes and perceptions towards high pressure processed chilled ready meals using the soft laddering technique. In this study four chilled ready meal product descriptions were used to stimulate attribute identification (see Table 1). These were chosen through discussions with the technical personnel involved in this research project. Respondents were asked to rank the four products identified by 3-digit codes in order of preference, where the presentation order was randomised. Respondents were then repeatedly asked to explain their potential purchase motivations by asking, "Why is that important to you"? The elicited attributes were then used as a basis to probe for and elicit consequences and values associated with each attribute. A supplementary questionnaire was designed to gather socio-demographic and lifestyle data, in addition to profiling their eating habits and shopping behaviours in relation to chilled ready meals.

Interviewees were recruited through a market research agency that selected and screened potential respondents for participation in the study in line with best practice. Interviewees were selected based on their involvement in the food purchase decision-making process. Potential respondents also had to purchase chilled ready meals at least 1 to 5 times every 6 months. In addition, only interviewees aged between 18 and 44 years could participate in the study as they encompassed the core target segments for chilled ready meals based on penetration and usage frequency levels<sup>[61, 62]</sup>. Forty purchasers of chilled ready meals were recruited to participate in the in-depth laddering interviews between December 2008 and January 2009. Interviews were conducted in consumers' home environment in order to put consumers at ease and to encourage openness in discourse. An experienced moderator conducted all in-depth interviews, which were audiotape recorded, and lasted approximately ninety minutes. All respondents were rewarded with a small payment for their participation in the study.

### **2.3. Data analysis**

The qualitative data generated from the in-depth consumer interviews was transcribed and analysed using the computer package NVivo 8™<sup>[63]</sup>. The questionnaires administered at the end of each in-depth interview were analysed using SPSS v14<sup>[64]</sup>. Content analysis on the laddering data was conducted to facilitate the aggregation of findings and generalisations across respondents. A dictionary of content codes or elements was generated and defined, which involved a preliminary review of the data and the development of an extensive set of element codes. Respondents' individual verbatims were then grouped together around a similar theme and assigned to a corresponding element code. The interactive data feature within the Laddermap software package was then used to assign verbatims and corresponding elements as either attributes, consequences or values, and consequently, assisted the researcher determine what constituted elements of varying levels of abstraction<sup>[58]</sup>. The Laddermap software allowed for the

generation of a lexical listing file that listed all elements as well as corresponding verbatims. This facilitated a thorough review of the inputted laddering data<sup>[65]</sup>. Following this, similar element codes were merged or grouped hierarchically. This was done to yield high enough frequencies to be included in the final hierarchical value maps without losing the meaning of specific elements<sup>[58, 59]</sup>. The next stage in the analysis involved the development of implication matrices for specific segments that summarised the direct and indirect associations between elements, and gave rise to quantitative assessments of all paired relationships<sup>[65]</sup>. Analysis of the triangular matrix files helped identify the main relationship between elements, which facilitated a further reduction in the number of elements. New implication matrices were then generated using the reduced number of elements to ensure that the resultant hierarchical value maps would come to represent the dominant perceptual orientations of consumers<sup>[59]</sup> (see Table 2).

**Table 1.** Chilled ready meal products evaluated by respondents

| <b>Product Code</b> | <b>Product Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>134</b>          | A new food preservation method called ‘high pressure processing’ is used to manufacture this ready meal. This allows the company to reduce the amount of additional processing needed, such as the temperature and/or cooking time, during the manufacturing process. This helps retain more nutrients, and ensures that fewer vitamins are destroyed during the manufacturing process. It retails at 10-20% above the normal price you would expect to pay for a chilled ready meal.                                                                                                                                       |
| <b>208</b>          | A new food preservation method called ‘high pressure processing’ is used to manufacture this ready meal. This allows the company to produce more natural chilled ready meals by reducing or eliminating chemical additives such as preservatives. It also allows the company to reduce the amount of additional processing needed, such as the temperature and/or cooking time, while ensuring food safety. High pressure processing extends the ‘best before’ and ‘use by’ dates so the ready meal stays fresher for longer. It retails at 10-20% above the normal price you would expect to pay for a chilled ready meal. |
| <b>351</b>          | This ready meal is produced in the factory using the current method of manufacture. It retails at the normal price you would expect to pay for a chilled ready meal.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>951</b>          | A new food preservation method called ‘high pressure processing’ is used to manufacture this ready meal. This allows the company to reduce the amount of additional processing needed, such as the temperature and/or cooking time, during the manufacturing process. This helps retain more of the natural flavours and texture of the meat and vegetables. It retails at 10-20% above the normal price you would expect to pay for a chilled ready meal.                                                                                                                                                                  |

The final stage in the laddering analysis involved the generation of segment specific hierarchical value maps. In order to determine which associations should be illustrated on a hierarchical value map, a cut-off value is chosen with each association compared to that cut-off value, where strength of associations greater or equal to the cut-off level are included<sup>[58, 59]</sup>. In this study a cut-off value of 4 was finally chosen as it was found to yield the most interpretable results. This cut-off value represented a significant number of associations with minimum threshold values ranging from 70-73%. The resultant hierarchical value maps represented the dominant perceptual orientations of consumers, which illustrated the inter-correlation between the attributes, consequences and values associated with high pressure processing. Analysis of the in-depth interview discussions and the resultant hierarchical value maps across socio-demographic variables revealed that the life stage variable best explained the variation in cognitive motives underlying consumers’ choices across a range of high pressure processed chilled ready meal concepts (see Table 3). In the hierarchical value maps the attributes are positioned near the bottom of the map, and are linked to values at the top of the map by consequences in the middle, where the thicker lines represent higher link counts and strengths between elements.

**Table 2.** Elements and associated synonyms elicited from in-depth laddering interviews

| <b>Element Type</b>    | <b>Element</b>               | <b>Abbreviated Synonym</b> |        |
|------------------------|------------------------------|----------------------------|--------|
| <b>Attribute</b>       | Better Quality               | Quality                    |        |
|                        | Contains Fewer Additives     | Additives                  |        |
|                        | Contains More Nutrients      | Nutrients                  |        |
|                        | Delivers Benefits            | Benefits                   |        |
|                        | Enhanced Nutritional Profile | Nutrition                  |        |
|                        | Enhanced Sensory Profile     | Sensory                    |        |
|                        | Extended Shelf Life          | Shelf-Life                 |        |
|                        | More Homemade                | Homemade                   |        |
|                        | More Natural                 | Natural                    |        |
| <b>Consequence</b>     | Price Premium                | Premium                    |        |
|                        | Avoid Snacking               | Snacking                   |        |
|                        | Can Do Other Things          | Activities                 |        |
|                        | Enjoy More                   | Enjoy-More                 |        |
|                        | Family Well Being            | Well-Being                 |        |
|                        | Feel Less Guilty             | Less-Guilt                 |        |
|                        | Fewer Illnesses              | Less-Sick                  |        |
|                        | Flexible Meal Plans          | Flexible                   |        |
|                        | Freedom of Choice            | Choice                     |        |
|                        | Generates Less Waste         | Less-Waste                 |        |
|                        | Happy Family                 | Happiness                  |        |
|                        | Low Stress Levels            | Low-Stress                 |        |
|                        | More Convenient              | Convenient                 |        |
|                        | More Energy                  | Energy                     |        |
|                        | No Perceived Value           | No-Value                   |        |
|                        | Satiety                      | Satiety                    |        |
|                        | Save Money                   | Save-Money                 |        |
|                        | Save Time During the Day     | Save-Time                  |        |
|                        | Shop Less Frequently         | Shop-Less                  |        |
|                        | Shop More Frequently         | Shop-More                  |        |
|                        | Spend on Other Things        | Thrift                     |        |
|                        | Stay Healthy                 | Healthy                    |        |
|                        | Taste Better                 | Taste                      |        |
|                        | Weight Control               | Body-Shape                 |        |
|                        | Work Productivity            | Work-Rate                  |        |
|                        | <b>Value</b>                 | Career Fulfilment          | Career |
|                        |                              | Duty of Care               | Duty   |
| Feel Better About Self |                              | Feel-Good                  |        |
| Financial Security     |                              | Security                   |        |
| Longevity              |                              | Longevity                  |        |
| Pleasure               |                              | Pleasure                   |        |
| Quality of Life        |                              | Good-Life                  |        |

### **3. Results**

#### **3.1. Sensory orientation**

The most dominant association was the belief that an enhanced sensory profile suggested a ‘more homemade’ taste, which in turn was linked to the consequences ‘taste better’ and ‘enjoy more’, leading to

the value ‘pleasure’. However, the frequency and strength of association between elements at the lower order levels of abstraction was greater for respondents in the family life stage than for pre-family life stage respondents. In contrast, a comparison of the hierarchical value maps revealed that information relating to sensory ‘pleasure’ was most important to respondents in the pre-family life stage given the frequency and the strength of the associations at the higher order levels of abstraction (See Figures 1 and 2). However, consumers did express a certain level of scepticism towards products making such claims based on past experiences.

**Table 3.** Socio-demographic and chilled ready meal consumption profile across life stage groups

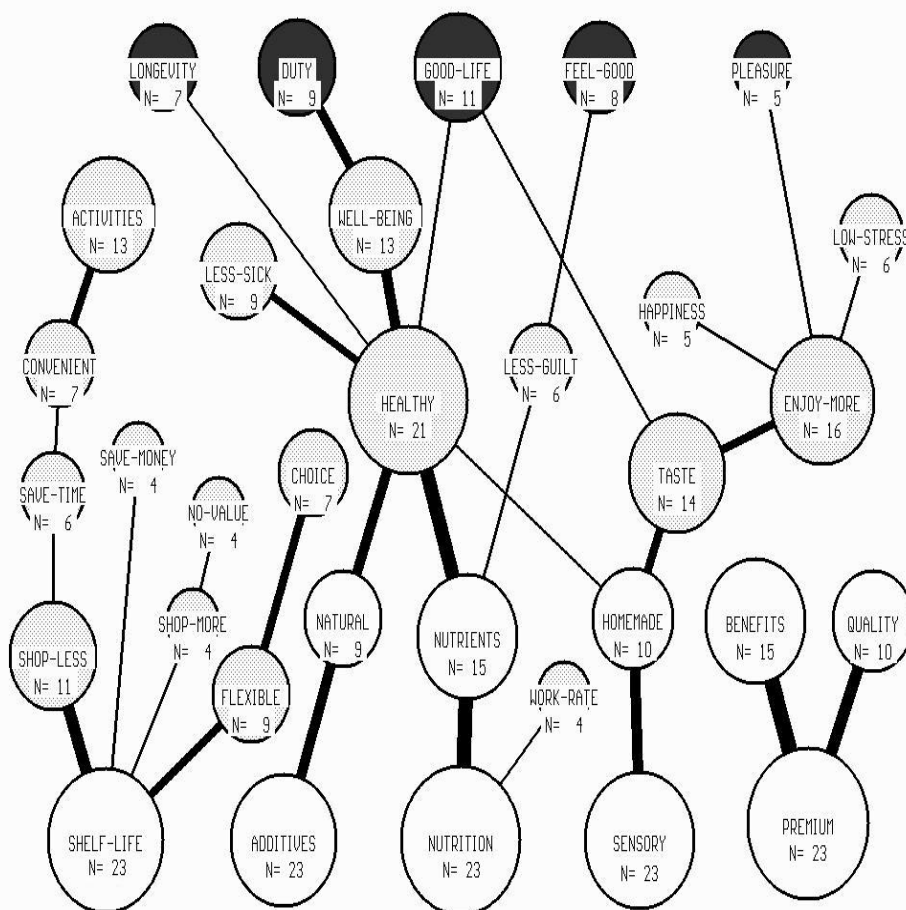
| Variable                                | Category                        | Pre-family |      | Family |      |
|-----------------------------------------|---------------------------------|------------|------|--------|------|
|                                         |                                 | N          | %    | N      | %    |
| <b>Group Size</b>                       | -                               | 17         | 42.5 | 23     | 57.5 |
| <b>Gender</b>                           | Male                            | 11         | 64.7 | 7      | 30.4 |
|                                         | Female                          | 6          | 35.3 | 16     | 69.6 |
| <b>Age Group</b>                        | 18-24yrs                        | 7          | 41.2 | 3      | 13   |
|                                         | 25-34yrs                        | 9          | 52.9 | 7      | 30.5 |
|                                         | 35-44yrs                        | 1          | 5.9  | 13     | 56.5 |
| <b>Highest Education Level Attained</b> | Primary Level                   | -          | -    | 2      | 8.7  |
|                                         | Intermediate Certificate        | 1          | 5.9  | 4      | 17.4 |
|                                         | Leaving Certificate             | 3          | 17.6 | 7      | 30.4 |
|                                         | Certificate/Diploma             | 4          | 23.5 | 9      | 39.1 |
|                                         | Primary Degree                  | 5          | 29.5 | 1      | 4.3  |
|                                         | Postgraduate Degree             | 4          | 23.5 | -      | -    |
| <b>Marital Status</b>                   | Single                          | 9          | 52.9 | 4      | 17.4 |
|                                         | Married                         | 2          | 11.8 | 17     | 73.9 |
|                                         | Cohabiting                      | 6          | 35.3 | 2      | 8.7  |
| <b>Social Class</b>                     | ABC1                            | 13         | 76.5 | 11     | 47.8 |
|                                         | C2DE                            | 4          | 23.5 | 12     | 52.2 |
| <b>Number Employed in Household</b>     | None                            | 1          | 5.9  | -      | -    |
|                                         | One Worker                      | 1          | 5.9  | 13     | 56.5 |
|                                         | Two Workers                     | 8          | 47.1 | 8      | 34.8 |
|                                         | More than Two Workers           | 7          | 41.1 | 2      | 8.7  |
| <b>Ready Meal Consumption Frequency</b> | Light (less than once per week) | 9          | 52.9 | 6      | 26.1 |
|                                         | Medium (once per week)          | 5          | 29.5 | 7      | 30.4 |
|                                         | Heavy (more than once per week) | 3          | 17.6 | 10     | 43.5 |

Interestingly, the abstract attribute ‘more homemade’ was not only linked to the consequence ‘taste better’ but also directly linked to ‘stay healthy’ for respondents in the family life stage, and indirectly for pre-family life stage respondents. However, the strength of association was weak for both consumer groups. The second most important consequence for respondents in the pre-family life stage, which was associated with ‘taste better’, was ‘satiety’. This was in turn linked to the consequences ‘avoid snacking’ and ‘weight control’ that led to the attainment of the value ‘feel better about self’. However, the strength of association between these elements was weak. Studies have shown that high pressure levels can result in changes to the colour of vegetables, as well as the development of off-flavours in meat associated with lipid oxidation [66, 67]. For some respondents in the family life stage a darkening in colour suggested a loss in freshness, while females, light consumers and respondents in the ABC1 grouping most frequently associated it with the perceived addition of additives. However, an equal number of respondents across groupings also perceived a darkening in colour in a positive way, which from their perspective suggested fresher and more nutritious vegetables. In contrast, lighter colour changes were negatively associated with over processing and a loss in either nutrients or freshness: “I always think the lighter the colour the more they have been boiled them or they have boiled the colour out of them” [Respondent 8: Female, aged 25-34yrs, pre-family life stage, medium consumer]. The vast majority of consumers acknowledged that while sensory expectations of chilled ready meals were not high, they were unwilling to accept chilled ready





common to both groups, the ladder pathways differed between them. Specifically, ‘contains more nutrients’ was directly linked to ‘feel better about self’ for respondents in the pre-family life stage grouping. In contrast, respondents in the family life stage felt less guilty and therefore felt good about themselves as a consequence of providing a more nutritious meal to their family members.



**Figure 2.** Hierarchical value map for consumers in the family life stage (cut-off level: 4, N= 23)

The vast majority of respondents inherently believed that over processing reduced the nutritional goodness of foods, and represented a strong leverage for differentiating high pressure processed chilled ready meals from incumbent products. However, high pressure processing indirectly delivers both the enhanced nutritional and sensory benefits through a reduction in the amount of thermal processing required to produce chilled ready meals. In that context, the in-depth discussions revealed that awareness of this fact could potentially give rise to food safety concerns and would represent a strong perceptual barrier to consumers’ acceptance of high pressure processing. Specifically, thermal processing was positively associated with assurances of food safety. On that basis, the converse rationale suggested that high pressure processing might represent a greater risk in terms of food safety: *“The more it is fully cooked the more likely the bacteria have been killed off. If it hasn’t been exposed to as much heat treatment as before, then that may be a concern”* [Respondent 16: Male, 25-34yrs, pre-family life stage, heavy consumer]. In addition, unintentionally undercooking meals represented a potent fear amongst respondents.

### 3.3. Convenience orientation

The extended shelf life chilled ready meal concept was most preferred by respondents in the pre-family life stage. However, consumers were sceptical of the concept of a chilled ready meal with a longer shelf life and fewer additives. More so, the attribute 'contains fewer additives' was more closely associated with positioning platforms that emphasised a health orientation for respondents in the pre-family and family life stages, and a sensory orientation for pre-family life stage respondents only (Figures 1 and 2). Respondents in the family life stage associated shopping less frequently with saving time and convenience, which in turn was strongly associated with the ability to engage in other activities such as spending more time with their children or close relatives (Figures 1 and 2). A dominant association amongst respondents in the pre-family life stage was the belief that an extended shelf life was strongly linked with less waste from spoilage. Consequently, less waste was strongly linked with the consequence 'save money', which in turn meant these consumers could spend the money saved elsewhere. The attribute 'extended shelf life' was strongly associated with the consequence 'flexible meal plans' for both groups'. However, the association between 'flexible meal plans' and 'freedom of choice' was stronger, and therefore more important, for respondents in the family life stage than the pre-family life stage group. In contrast, the attribute 'extended shelf life' was negatively associated with the consequence 'no perceived value' for respondents that shopped frequently for chilled ready meals, which illustrated that freshness was most desired by this consumer group. More so, the belief that manufacturers and retailers would equally benefit from a chilled ready meal with extended shelf life was strong amongst these respondents. Interestingly, the hierarchical value maps revealed that a premium pricing strategy was strongly linked with the consequences 'better quality' and 'delivers benefits' (Figures 1 and 2).

## 4. Conclusions

The in-depth consumer discussions revealed that the enhanced nutritional profile chilled ready meal concept garnered higher levels of consumer acceptance and especially amongst respondents in the family life stage. This could be attributed to the inherent belief in the negative effect of thermal processing on the nutritional quality of foods. However, differentiating high pressure processed chilled ready meals from conventionally produced meals based on a less severe cooking process could potentially accentuate perceptual barriers towards the technology based on; perceived food safety risks associated with a reduced thermal processing either in the factory or in home; and misconceptions regarding the influence of high pressure on elements of eating quality. Clearly, the depth of information required to effectively differentiate high pressure processed chilled ready meals from conventionally produced meals represents a considerable challenge for companies. Analysis of the hierarchical value maps revealed differing motivational cognitive ladders across consumer groups, which highlighted the importance of differentiated positioning and communicating strategies for new product success. Interestingly, the value 'longevity' although important to respondents in the family life stage was not strongly associated with the consequence 'stay healthy' for either group. Consequently, the results suggested that the technical development and market positioning of the enhanced nutritional profile concept on a platform that would emphasise duty of care would be an important strategic decision for companies targeting respondents in the family life stage. In contrast, companies should pursue positioning and communication strategies that would emphasise quality of life and career fulfilment for respondents in the pre-family life stage.

Generally, consumers expressed a degree of scepticism towards the sensory orientation product platform given their experience with products in the past that made similar claims yet never managed to live up to expectations. Expectations of pleasure represented an extremely important positioning leverage for respondents in the pre-family life stage given that this value belonged to the strongest motivational cognitive ladder for the enhanced sensory profile concept platform. From a new product design perspective, the hierarchical value maps identified two key abstract attributes of importance to product developers, 'more natural' and 'more homemade', which consumers would be expected to use as intrinsic and extrinsic cues to stimulate the development of motivational cognitive structures. Interestingly, while the attribute 'more homemade' was connected to both the health-oriented and sensory-oriented product platforms, the attribute 'more natural' was linked to a health orientation only. However, the associations relating to these attributes at the lower levels of abstraction were weak amongst respondents in the pre-family life stage. This suggested that communication strategies would need to focus on strengthening

these associations at the lower levels of abstraction to ensure that these consumers would make the link between a product's key attributes and the attainment of higher order values.

Integrating consumers with the NPD process is critical for the identification of new product concepts that will ultimately be met with high levels of consumer acceptance. For example, in the case of the extended shelf life chilled ready meal concept, consumers that frequently purchased chilled ready meals did not perceive value from a chilled ready meal with an extended shelf life. Similarly, the majority of consumers expressed scepticism towards the concept of a longer shelf life chilled ready meal that contained fewer additives. The hierarchical value maps also revealed that a food safety orientation represented neither an attribute nor a consequence associated with this new product concept. This suggested that a food safety orientation would lack a distinct competitive advantage from the consumer's perspective. This possibly reflected a low perceived food safety risk associated with the chilled ready meals category, or perhaps an inherent expectation on the part of consumers that chilled ready meals should be safe for consumption. Instead, the hierarchical value maps suggested that a convenience orientation platform would represent a lower risk in terms of new product failure. Specifically, the hierarchical value maps suggested that a positioning strategy for the extended shelf life concept should focus on a platform that would promote functional benefits, such as thrift with regard to personal finances and/or flexible meal planning, for respondents in the pre-family life stage. In contrast, respondents in the family life stage were primarily driven by the psychosocial consequence 'can do other things', which for this group denoted spending more time with family members.

Innovation represents an extremely important strategy for companies to pursue in order to meet consumers' growing demand for new food products, and to remain competitive in the marketplace<sup>[68]</sup>. The challenge for companies therefore lies in developing innovative products that surpass consumers' current expectations, while managing the associated level of risk in terms of new product failure. This is especially relevant to company's pursuing a radical innovative strategy in an industry that traditionally is not perceived as radically innovative by consumers<sup>[68]</sup>. In that respect, this research highlighted the important role consumers have to play as 'co-designers' in the early stages of the NPD process. Integrating consumers' perceptions and cognitive choice motives at the concept ideation and screening stages of the NPD process can help identify and minimise consumer acceptance issues associated with radically innovative new products, and can guide companies in the design of positioning and communicating strategies that are market-focused and consumer-relevant. Indeed, the findings of this research suggest that as chilled ready meal manufacturers move across the product development continuum towards more radical new product propositions, addressing consumer acceptance issues in terms of misconceptions of product quality, perceived food safety risks, product design and product positioning become even more important than hitherto with incumbent chilled ready meals. The incorporation of consumers' value-creation at the concept stages of the NPD process can assist companies reduce the levels of uncertainty in NPD through the identification of consumer-led high pressure processed meals with high levels of perceived quality and added value, and consumer satisfaction.

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