Managing Customer Knowledge during the Concept Development Stage of the New Food Product Development Process

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Abstract. *New product development (NPD) is a knowledge intensive process where the generation of new ideas and concepts requires detailed knowledge of both products and customers. The high reported failure rates for innovative functional beverages suggest an inability to manage customer knowledge effectively, as well as a lack of knowledge management between functional disciplines involved in the NPD process. This research explored the concept of managing customer knowledge at the early stages of the NPD process, through the use of advanced concept optimisation methods, and applied it to the development of a range of functional beverages. A conjoint-based survey was administered to four hundred customers in Ireland. This research identified two hypothetical functional beverage concepts with high levels of customer acceptance. Managing customer knowledge during the concept development stage of the NPD process can assist firms overcome customer acceptance issues associated with innovative products. Methodologies that advance both a firm's understanding of customers' choice motives and value systems, and its knowledge management process, can increase the chances of new product success in international food and beverage markets.*

Keywords: Knowledge Management, New Product Development, Functional Beverages.

1. Introduction

1.1. Knowledge management and new product success

Organisations require information from both internal and external sources to evaluate and monitor business activities as well as make informed business decisions. Consequently, knowledge is widely considered one of the most important intangible resources that firms can possess, and is considered essential to the development of organisations [1]. However, knowledge can only become an asset to a firm if it is enhanced, managed and effectively used [2]. In that context, knowledge management is the management function that creates and manages the flow of knowledge within an organisation, and ensures that knowledge is used effectively and efficiently for the long-term benefit of an organisation [3]. New product development (NPD) is considered a knowledge intensive process where the generation of new ideas and concepts requires detailed knowledge of both products and customers. The multi-disciplinary nature of the NPD process therefore necessitates the generation, dissemination and management of knowledge across all functions involved in the development of new products. Indeed, knowledge management is now widely considered a key factor for NPD success [4, 5, 6]. It is believed that effective knowledge management can lead to higher levels of integration and knowledge transfer between functional disciplines, and thereby promote a more flexible and efficient multi-disciplinary NPD process on which a competitive advantage can be built and sustained [7, 8]. More so, effective knowledge management is regarded as an extremely important tool within organisations for the promotion of creativity where several researchers have reported a strong relationship between knowledge-based organisations, creativity in idea generation and new product success [9, 10, 11, 12]. Importantly, the key dimensions of knowledge management orientation, namely knowledge generation and knowledge dissemination, are considered key dimensions of

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market orientation [13, 14]. So how can firms manage knowledge more effectively during the new food product development process?

1.2. Managing customer knowledge in the new food product development process

The early stage of the NPD process is the period when new product opportunities are first considered and move through the stage-gate NPD process for further development. These front-end activities are believed to be inter-related, and that an oversight in relation to front-end activities can lead to product failure [15]. Uncertainty is therefore an inherent characteristic of the NPD process, in terms of identifying concepts that are most promising, and whether new concepts can gain customer acceptance. Consequently, poor knowledge management at the early stage of the NPD process can result in both product design and customer acceptance problems arising in the later stages of the NPD process, where development costs incurred can be extremely high [16]. The early stage of the NPD process therefore presents an opportunity to create value with, rather than for, the customer. Seeing as customers are the final stakeholders and arbiters of new products, involving customers at the early stage of the NPD process would be expected to reduce the uncertainty associated with the process of product development. In that sense, market orientation is considered the most efficient means of managing customer knowledge, as market-oriented firms are considered proficient at gathering and disseminating information and knowledge [13, 14].

The incorporation of customers' value-creation at the early stage of the NPD process is believed to make organisations better able to adapt to changes in customers' needs [17]. This ultimately leads to the creation of a deeper relationship with the customer and creates more effective and efficient opportunities for acquiring knowledge, and ultimately leads to higher levels of quality and customer satisfaction [18]. In new food product development the customer has an extremely important role to play at the concept development stage of the NPD process in two respects: the customer as a resource, and the customer as co-designer in NPD [19]. In market-oriented organisations customers are viewed as significant co-designers since they can make an effective contribution to product design and acceptability [20, 21]. In effect, it is believed that the integration of customers with the multi-disciplinary NPD process can bring NPD practitioners closer to understanding customers' needs and wants [22]. Consequently, market-oriented firms, which promote inter-departmental co-ordination, would be expected to have a clear understanding of customers' needs, manage knowledge more effectively and efficiently, develop superior new products and services to meet their needs, and therefore, positively influence the degree of innovation in firms [23].

Importantly, integration between functions and customer knowledge management can both be facilitated during the concept development stage of the NPD process through the use of advanced concept optimisation research techniques such as focus groups, conjoint analysis and sensory analysis [20, 22]. However, uptake of formal concept optimisation research methodologies across sectors and industries remains low or is applied in an ad-hoc fashion [24, 25]. Gathering customer information through formal concept optimisation research methods results in information that can be more easily disseminated throughout the organisation [14]. More importantly, advanced concept optimisation research methods facilitate closer integration between technical Research and Development (R&D) and marketing functions in the new food product development process, which is a key factor for new product success [26]. This market-oriented approach to NPD can help ascertain the feasibility and level of market acceptance of new product concepts, define target customer groups, and identify the optimal extrinsic and intrinsic attributes driving customers' preferences and acceptance of innovative foods and beverages [22, 27]. Strategic reviews of food and beverage industries worldwide consistently emphasise the need for firms to improve their innovation and marketing

capabilities, in order to maintain competitiveness in both domestic and overseas markets. In particular, the functional food and beverages market has been singled out as an extremely important emerging market, which firms could benefit from through an increased technological and market orientation.

1.3. New product development in the functional food and beverages market

Firms require a knowledge management process that is both dynamic and flexible, and which can respond to changes to a firm's innovation strategy [28]. In particular, it is argued that the management style, and the importance of knowledge management and knowledge dissemination to innovation, depends upon the type of innovation pursued by a firm [29, 30]. Specifically, knowledge management is considered extremely important to technology-oriented NPD strategies due to the high level of risk associated with radical innovations, such as functional food and beverages, where firms need to manage knowledge more effectively in order to stay close to customers [31, 32]. Indeed, functional foods and beverages can be characterised as radically innovative or 'breakthrough' products that on one hand provide value to customers, in terms of their inherent health benefits, while on the other hand potentially deliver long-term profitability and competitive advantage in the marketplace [33, 34]. The functional food and beverages market has therefore come to represent an extremely important strategic and operational orientation for food and beverage, biotechnology and pharmaceutical firms, as a result of changing market dynamics and customer trends [33, 34, 35]. However, these emerging new product categories present considerable challenges to firms in terms of identifying and developing technological 'breakthrough' products on one hand, and the marketing of science and technology to customers on the other. In fact, while 'breakthrough' products potentially offer value or benefits to customers over incumbent products, customer acceptance of novel 'breakthrough' products is considered slower than for conventional products [36].

It is reported that approximately 70 to 90 per cent of new functional food and beverages fail within the first year, which can be attributed to: poor customer acceptance from both a marketing and sensory perspective; efficacy and legislative issues concerning functional food labels; poor customer education; incorrect pricing, promotion and positioning strategies; and ineffective market segmentation [37, 38, 39, 40]. In fact, it is argued that many functional food and beverage firms rely solely on the functionality or health benefits, and neglect other unique selling point factors such as aspects of sensory appeal or convenience, in order to gain a competitive advantage in the food and beverages market [37, 41, 42, 43]. In particular, it has been shown that even though functional beverages offer health benefits, off-flavours can act as a deterrent to customer acceptance, especially when beverages lose their refreshment and pleasure appeal [44, 45]. Not surprisingly, for technology-oriented firms, a differentiation strategy based solely on functionality and associated health benefits offers a short-term competitive advantage only: *"often technology is used to create value for the producer and this can sometimes be a very different matter from creating customer value"* [46]. These insights into the development and strategic marketing of functional foods and beverages would suggest that customer acceptance issues at this early stage of the NPD process are either ignored or poorly understood by firms, resulting in organisational failure to manage customer knowledge effectively, as well as a lack of knowledge management between disciplines involved in the NPD process [41, 47].

Consequently, this research explored the concept of managing customer knowledge at the concept development stage of the NPD process, through the use of advanced concept optimisation research techniques, using the development of gut benefit juice-based functional beverages as an example. Gut benefit juice-based functional beverages were chosen for this study as juice manufacturers were considered to lead NPD activities for gut benefit non-dairy beverages as line extensions of existing functional drinks, with gut

benefit juice-based drinks expected to become an increasingly important category in future years [48, 49].

2. Research objectives and methodology

2.1. Research objective

The main objective of this study was to evaluate the contribution of advanced concept optimisation research techniques to managing customer knowledge during the concept development stage of the NPD process, using the development of gut benefit juice-based functional beverages as an example.

2.2. Research methodology

Conjoint analysis is a multivariate concept optimisation research technique that models the purchase decision-making process though an analysis of customer trade-offs among hypothetical multi-attribute products [50]. In conjoint analysis, a product can be described as a combination of a set of attribute levels, where a utility value is estimated for each attribute level that quantifies the value that an individual places on each attribute level. The utility values, contributed by each attribute level, then determine customers' total utility or overall judgement of a product [51]. The product attributes and attribute levels used in this research were derived from a previously conducted qualitative study that investigated customers' preferences for functional beverages [41] (See Table 1). The full-profile conjoint analysis approach was chosen for this study as it presented customers with realistic descriptions of alternative functional beverage concepts [51]. The orthogonal design procedure in SPSS, which used a fractional factorial design, made it possible to gather information on a large number of beverage concepts although customers only rated a limited number of beverage concepts. Importantly, the fractional factorial design maintained the effectiveness of evaluating the relative importance of a beverage's multi-dimensional attributes [50]. The fractional factorial design generated 20 hypothetical functional beverage concepts of which 4 were holdout beverage profiles. The 4 holdout beverage profiles would be rated by customers but not used in the estimation of utility values. These holdout beverage profiles made it possible to determine how consistently the conjoint model could predict customers' preferences for innovative functional beverages that were not evaluated in the survey [52].

Table 1. Product attributes and associated product attribute levels

Product Attribute	Product Attribute Level
Brand	Familiar Brand New Brand
Type of Juice	Freshly Squeezed Not from Concentrate Made from Concentrate
Texture	Contains Fruity Bits Smooth Style
Flavour	Tangy, Sharp, Slightly Bitter Slightly Sweet Sweet
Health Benefits	None Aid the Immune System Aid the Digestive System

Price	€1.90 per Litre €2.80 per Litre €3.70 per Litre

The conjoint-based study was administered using a paper-based questionnaire and was divided into four sections. In Section 1 respondents were verbally presented with twenty hypothetical functional beverage concepts to rate on a nine-point Likert scale corresponding to how likely they would purchase each hypothetical beverage concept. Section 2 consisted of ten multiple-response questions to determine respondents' purchase behaviour and consumption of conventional and functional juice-based beverages. In Section 3 respondents' purchase behaviour towards selected functional products was determined using five questions, through a combination of dichotomous style and multiple-response questions. Section 4 gathered both lifestyle and socio-demographic information. A significant methodological critique of the full-profile conjoint analysis method concerns the increased possibility of respondent fatigue, which can result in reliability and validity problems, as the number of attributes and associated attribute levels increase [50]. A number of steps were therefore taken in order to reduce the possibility of respondent fatigue. Firstly, the most relevant product attributes were selected based upon previous research [41]. Secondly, the conjoint-based questionnaire was then pilot tested to determine: the validity of the model; customers' understanding of the procedure; and the time required to complete the questionnaire. Following the pilot survey, four hundred conjoint-based questionnaires were administered by means of a non-probability sampling method, using a combination of intercept and purposive sampling, in Cork and Dublin, Ireland.

2.3. Data analysis

The questionnaires were analysed using SPSS v11 [53]. The individual level conjoint analysis procedure in SPSS calculated coefficients using ordinary least square estimations, expressed as utility values, which linked the attribute levels to changes in product ratings [52]. The derived utility values were then used to determine the importance (expressed out of 100) of each attribute. Pearson's R and Kendall's tau association values were used to assess the validity of the conjoint analysis model. The Pearson's R (0.988) and Kendall's tau (0.958) values were high and indicated strong agreement between the averaged product ratings and the predicted utilities from the conjoint analysis model. K-means cluster analysis was then used to segment customers into distinct clusters based on attribute utility patterns. K-means cluster analysis requires specifying the number of clusters a priori. Therefore, the optimal number of clusters was determined by observation of the agglomeration schedule to identify respondents with similar preferences [53].

In addition to providing estimates of the value customers associate with various product attributes, conjoint analysis data can also be used: to simulate market share estimations for both new and competitive products; to evaluate the potential of a multi-product strategy; and to predict trade-offs which customers would be willing to make between product attributes and within attribute levels [54]. Kendall's tau correlation for the four holdout cards was used to determine how consistently the conjoint model could predict customers' preferences for functional beverage concepts, where a high positive value would indicate strong agreement between the holdout ratings and the model predictions [53]. Overall, a Kendall's tau value of 0.667 for the four holdouts suggested less than perfect agreement between the holdout ratings and the model predictions although this value was within acceptable limits [53, 55]. It was therefore possible to analyse customers' preferences for alternative functional beverage concepts, which were not evaluated in the survey, through simulation analysis, and the choice simulation models used employed both maximum and probability (Bradley, Terry, Luce (BTL) and Logit) modelling [56]. These models estimate the market share for each product by estimating the value that each

participant associates with each hypothetical product included in the simulation analysis. However, the predictive power of probability models is believed to be greater than the predictive power of the maximum utility model in repetitive purchasing situations associated with low involvement products such as foods and beverages.

The hypothetical functional beverage concepts could have represented new market (competitor) entrants or alternative marketing strategies. However, in this study the hypothetical functional beverage concepts used in the simulation analysis represented new product offerings that firms might wish to commercialise. The hypothetical functional beverage concepts used in the group level simulation analyses were generated according to product profiles that closely matched existing products in the marketplace, from observations of the cluster analysis results, and from discussions with the technical partners involved in this project. The group level simulation analysis technique therefore represents a powerful tool which can assist product development personnel predict customers' preferences for new hypothetical product concepts at the early or concept development stage of the NPD process.

3. Results

The individual level conjoint analysis procedure in SPSS revealed that customers were most influenced by the price and the type of juice attributes when choosing between alternative beverage concepts. The health benefits and flavour attributes were also important in terms of customers' choice motives. K-means cluster analysis identified four clusters (Clusters 1 to 4) out of five with preferences for similar hypothetical functional beverage concepts. A group level simulation analysis was then performed across clusters that expressed a preference for functional beverages.

3.1. Group level simulation analysis

In this study the hypothetical functional beverage concepts were generated following rigorous analysis of the cluster analysis data, and from discussions with the technical partners involved in this project. However, interpreting the cluster analysis results for the purpose of designing the simulation analysis research must be approached carefully. For example, the group level simulation analysis procedure in SPSS could be used to identify functional beverage concepts specifically targeted at each segment identified in this study. This strategy is most appropriate when customers' preferences differ markedly across clusters, and in competitive markets where a firm needs to segment selectively in order to gain a superior competitive advantage in the marketplace. However, the group level simulation analysis technique was used in this study to identify a limited number of functional beverage concepts that would appeal to a number of customer segments. This strategy is most appropriate in emerging markets, such as the gut benefit non-dairy beverage market, or where customers' preferences are relatively similar across clusters. In addition, it appeared that all four clusters that preferred functional to regular beverages, exhibited relatively similar preferences for gut benefit juice-based beverages. Therefore, six hypothetical functional beverage concepts (PROBEV 1 - PROBEV 6) were generated for the group level simulation analysis across clusters (See Table 2).

Table 2. Group level simulation analysis for a range of hypothetical functional beverage concepts across clusters

Attributes/Preference Scores	PROBEV 1	PROBEV 2	PROBEV 3	PROBEV 4	PROBEV 5	PROBEV 6
Brand	New Brand	New Brand	New Brand	New Brand	Familiar Brand	Familiar Brand
Juice Type	Freshly Squeezed	Made From Con.	Freshly Squeezed	Freshly Squeezed	Made From Con.	Freshly Squeezed
Texture	Contains Fruity Bits	Contains Fruity Bits	Contains Fruity Bits	Contains Fruity Bits	Contains Fruity Bits	Contains Fruity Bits
Flavour	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet	Slightly Sweet
Health Benefits	Aid the Digestive System	Aid the Digestive System	Aid the Digestive System	Aid the Digestive System	None	None
Price	€1.90 per L	€1.90 per L	€2.80 per L	€3.70 per L	€1.90 per L	€2.80 per L
Cluster 1 (Pref. Score)	7.0 out of 9	5.8 out of 9	6.2 out of 9	5.7 out of 9	5.2 out of 9	5.5 out of 9
Cluster 2 (Pref. Score)	7.6 out of 9	7.0 out of 9	6.0 out of 9	4.8 out of 9	6.3 out of 9	5.9 out of 9
Cluster 3 (Pref. Score)	8.1 out of 9	8.0 out of 9	7.3 out of 9	6.2 out of 9	7.9 out of 9	7.1 out of 9
Cluster 4 (Pref. Score)	8.2 out of 9	6.7 out of 9	7.6 out of 9	6.4 out of 9	5.1 out of 9	6.0 out of 9

PROBEV 1 was included in the group level simulation analysis since this beverage concept would be expected to yield high predicted preference scores for all four segments according to Table 2. However, new product concepts that combine the optimal product design attributes may not represent commercially feasible new products. This simplistic approach to new product design neglects the multi-faceted nature of customer food choice, where the interplay between market-related factors such as price, and product-related factors such as sensory and health perceptions and user benefit, ultimately influence customers' cognitive food choice motives. Therefore, five further hypothetical functional beverage concepts (PROBEV 2 – PROBEV 6) were included in the simulation analysis. The hypothetical beverage concepts PROBEV 2 – PROBEV 4 which were variants of PROBEV 1, in terms of price and health benefit levels, were included to identify which customer segments would be expected to make trade-offs between key market and product-related attributes, when evaluating alternative gut benefit juice-based beverage concepts. PROBEV 5 and PROBEV 6 represented regular juice-based drinks.

Overall, the conjoint models predicted that Clusters 1 and 4 would not make trade-offs between the type of juice and price when evaluating alternative functional beverage concepts (See Table 2). Membership of Cluster 1 was skewed towards females (76%) and respondents in the 18-24 (22%), 30-34 (16%) and 55-59 (20%) year age groups. This segment contained the highest percentage of purchasers of gut benefit yoghurt drinks (72%) across clusters, and significant relationships were found between age ($p \leq 0.001$), the number of children aged 17 years or less ($p \leq 0.001$), and gut benefit yoghurt drink purchase behaviour (See Table 3). Similarly, Cluster 4, the functionality driven segment, also contained the highest percentage of respondents that purchased gut benefit products across clusters, and significant relationships were observed between age ($p \leq 0.001$), gender ($p \leq 0.001$), educational level attained ($p \leq 0.001$), and purchase behaviour for both gut benefit smoothies and supplements.

In contrast, the conjoint models predicted that Clusters 2 and 3 would make trade-offs between the type of juice and price attributes. Specifically, the conjoint models predicted that these segments would prefer PROBEV 2 to PROBEV 3 (See Table 2). Interestingly, the K-means cluster analysis revealed that Cluster 2, the largest segment identified in this study, was the most price sensitive cluster across segments, while Cluster 3 expressed equal preference for both freshly squeezed and 'made from concentrate' juice-based beverages. Cluster 2 contained an equal proportion of male to female respondents, and the age profile of this segment was biased towards respondents in the 25 to 34 (50%) and 50 to 59 (20.3%) year age groups. Membership of Cluster 3 was biased more towards females (67.7%) and older age groups (See Table 3).

4. Conclusions

New food product development is a multi-disciplinary knowledge intensive process, which necessitates the generation, dissemination and management of knowledge across all functions involved in the development of new foods and beverages. The early stage of the NPD process, in particular, represents an extremely critical stage for managing knowledge of both internal technological capabilities and external measures of customers' needs. The increasingly competitive nature of the functional food and beverages market, and the inherent risks associated with the new food product development process, highlight the significance of knowledge management to the NPD process. A market-oriented approach to NPD that facilitates the effective and efficient management of customer knowledge represents an essential strategic orientation for firms pursuing market opportunities in the functional food and beverages market. This study provides new insights into customers' acceptance of innovative functional beverages, with implications for the strategic marketing and new product design of innovative functional beverages by firms.

Overall, the results of this research has future implications for the way in which technology-oriented firms view and assess the market attractiveness of the functional food and beverages market. With increasingly competitive markets, functional food and beverage manufacturers have targeted functionality, vis-à-vis the health benefits offered, as an extremely important marketing tool in creating value and a competitive advantage in order to differentiate their product offering from their competitors. However, the findings of

Table 3. Socio-demographic profiles across clusters

Attribute Level	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Cluster Size	100	148	62	36	54
Gender					
Male	24.0%	50.0%	32.3%	61.1%	29.6%
Female	76.0%	50.0%	67.7%	38.9%	70.4%
Age Group (years)					
18-24	22.0%	23.0%	16.1%	5.6%	-
25-29	6.0%	13.5%	9.7%	5.6%	25.9%
30-34	16.0%	13.5%	12.9%	33.3%	-
35-39	-	-	-	33.3%	14.8%
40-44	14.0%	9.5%	-	-	7.4%
45-49	12.0%	5.4%	9.7%	-	7.4%
50-54	10.0%	13.5%	9.7%	-	33.3%
55-59	20.0%	6.8%	16.1%	22.2%	-
60-64	-	8.1%	3.2%	-	11.1%
65-69	-	-	22.6%	-	-
70-74	-	1.4%	-	-	-
75+	-	5.4%	-	-	-
Educational Status					
No Formal Education	-	4.1%	-	-	-
Primary Level	4.0%	-	6.5%	-	-
Intermediate/Junior Cert.	8.0%	6.8%	6.5%	33.3%	7.4%
Leaving Cert.	38.0%	25.7%	19.4%	-	-
Pursuing Further Edu.	18.0%	13.5%	19.4%	5.6%	-
Completed Further Edu.	32.0%	50.0%	48.4%	61.1%	92.6%
Social Class**					
A	-	12.2%	-	11.1%	7.4%
B	38.0%	17.6%	12.9%	27.8%	63.0%
C1	22.0%	28.4%	22.6%	44.4%	3.7%
C2	18.0%	17.6%	51.6%	16.7%	18.5%
D	22.0%	17.6%	12.9%	-	7.4%
E	-	6.8%	-	-	-
No. Children (≤17 yrs)**					
None	66.0%	86.5%	93.5%	72.2%	100%
1 Child	20.0%	12.2%	6.5%	-	-
2 Children	14.0%	1.4%	-	27.8%	-
Gut Benefit Yoghurt Drinks Purchased**					
Yes	72.0%	52.7%	51.6%	66.7%	11.1%
No	28.0%	47.3%	48.4%	33.3%	88.9%
Gut Benefit Supplement Purchased*					
Yes	38.0%	10.8%	29.0%	44.4%	-
No	62.0%	89.2%	71.0%	55.6%	100%

* Significant at $p \leq 0.05$
** Significant at $p \leq 0.001$

this research suggest that functional foods and beverages represent a niche market opportunity for firms pursuing a technology-oriented NPD strategy. However, the market-oriented approach to NPD outlined in this study identified market segments, with similar preferences, for selective functional beverage concepts. In addition, functional foods and beverages have both proved attractive to firms seeking to develop

and maintain premiums in these emerging markets. Generally, the poor sales performance of functional foods and beverages to-date can be partially explained by the pursuance of a mass-marketed product through a premium pricing strategy [37 38, 41]. In that context, the simulation analysis made it possible to determine whether customers would be willing to trade-up or make trade-offs between key intrinsic attributes, functionality, type of juice and price. In this study the simulation analysis across clusters revealed that two of the four segments (Clusters 2 and 3) would make trade-offs between the type of juice and price. On that basis, advanced concept optimisation research techniques such as conjoint analysis can help firms identify, and understand, the interactions and relationships driving purchasers' choice motives for specific functional foods and beverages. This in turn can assist food and beverage manufacturers in identifying the optimal product design attributes, and associated optimal price or premium that customers would be willing to pay for added functional ingredients to foods and beverages.

To improve on the poor market performance of new functional foods and beverages a greater emphasis towards high levels of customer involvement and integration with the NPD process is required. In this study it is argued that advanced concept optimisation research methods can facilitate the integration of the customer with the new food product development process, and enhance customer knowledge management at the early stages of the NPD process. Advanced concept optimisation research techniques can be used to generate valuable product design knowledge, by transforming tacit customer information to explicit actionable knowledge, which can guide the strategic marketing and new product design of innovative foods and beverages, in a market-oriented fashion. This in turn promotes high levels of integration between the technical R&D and marketing functions, leading to more effective and efficient knowledge management in the NPD process. Advanced concept optimisation research techniques that advance a firm's understanding of customers' food choice motives and value systems, through the integration of the customer during the concept stage of the food product development process, can increase the chances of NPD success.

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