

CHAPTER 4

Product Strategy Development: Product Concepts and Product Design Specifications

4.1 Introduction

The development from the simple product idea to the product design specifications and finally the product specifications is a continually evolving process through the initial stage of the product development process to the end of the product design stage. It is a creative but focussed process. There is creativity in developing the ideas for the type of product and then for the detail of the product, but this is tempered by the aim and constraints of the project. It is important that the creativity does not lead to a product that is outside the business strategy.

In the food industry, the product and the packaging are designed together because the package is an integral part of food preservation and food use. This is different from other manufacturing industries where the package is designed after the product as a method of protection and display. Product design in the food industry has also had a different philosophy and organisation from design in other industries. It has been less technical and more consumer-oriented for two reasons: product design has come from recipe formulation in cooking, and food has an intimate relationship with every consumer. Today there is the knowledge for more technical food design because the requirements of total quality management (TQM) and hazard analysis control points (HACCP) demanded more technical product/processing knowledge in all companies. There is also the pressure from the consumer for safety and nutrition in foods to drive this technical approach, and for more consideration of their needs to drive the consumer-oriented approach to design.

Food industry designers could benefit from studying the work of designers in other industries and vice versa. The industrial designers do little consumer research during the design and could benefit from studying the techniques of the food designers; the food designers could benefit from the more technically rigorous design procedure and also the aesthetic qualities of the industrial design. The food service industry is leading this development in food design, with chefs often now calling themselves food designers and working with other designers.

The product concept develops from the first description of the product idea to the final product specifications controlling production and to the product proposition that the marketers present to either the retailers or the industrial customers. Sometimes there is a confusing use of the term product concept, but this is reduced if different names are given to the various stages of the product concept development: product idea concept, product concept, product design specifications, product specifications, product proposition as shown in Figure 4.1

In product concept development and product design, there is cooperation between the consumer, the marketer, the production and engineering staff and the product developer. This interaction is important and needs to be coordinated so that there is translation of consumer needs and wants into both a technical product and process, and also a marketing plan. Figure 4.1 shows the most important participants at each stage in the Product Process, but there also needs to be interactive discussions with other people in the company and in the market throughout the project to achieve integration. In consumer marketing of food, it is important to recognise that there are two groups – the people who buy the products (sometimes called customers) and the people who eat the products (the final consumers). There is often a tendency to group them all together as “consumers”, but the reasons that the person chooses food to buy for the household can be different from why the consumers want to eat the food.

Figure 4.1 Evolution of the product description in the PD Process

DESCRIPTION	MOST IMPORTANT COMPANY PARTICIPANTS
Product idea name	Company PD group, consumer research group
↓	
Product idea description	Company PD group
↓	
Product idea concept	Consumer research group
↓	
Product concept	Consumer research group, marketing, technical, company PD group
↓	
Product design specifications	Technical, marketing, consumer research group, company PD group
↓	
Product specifications	Technical, company PD group
↓	
Product proposition	Marketing, consumer research group

During product design in the food and other processing industries, there is an interlocking of the raw material production, processing and storage with the product design. The processing and storage conditions as well as the raw material quality determine the product qualities. So in product design there is systematic optimisation of product quality by experimenting with the raw materials, processing and storage; these technical details are also included in the product design specifications. The activities and product outcomes in the development of the product concept and product design specifications are shown in Figure 4.2

Figure 4.2 Activities in developing the product concept and product design specifications

MARKETING	CONSUMER	TECHNICAL
<u>PRODUCT IDEAS</u>		
Product ideas descriptions development		
	Consumer product ideas screening	Product characteristics identification
<u>PRODUCT IDEAS DESCRIPTIONS</u>		
Product idea concept development		
Desk market search	Consumer concept development	Internal technical search
<u>PRODUCT IDEA CONCEPTS</u>		
Product concept building and evaluation		
Market survey	Consumer screening	Literature searching
Competitive products	Consumer survey	'Mock-up' prototypes
<u>PRODUCT CONCEPT</u>		
Product concept engineering		
Pricing, distribution, promotion, information	Consumer groups: product profile	Processing information Product qualities
<u>PRODUCT DESIGN SPECIFICATIONS</u>		

The 'product concept' is not one definition made at the beginning of the product development project but it changes and develops as the project progresses. It starts as a consumer-based product concept, which gradually develops into a working brief for the project, and then develops further as detailed consumer descriptions of product characteristics based on examination of the prototype products, to the final product concept related to the consumer and the marketplace which is used for the design. The product concept at any stage acts as a guide to the product development.

The basis for the operational activities in the product launch is set at this stage; if this stage is vague and non-technical it causes trouble in the product commercialisation. The product concept along with the aims, objectives and constraints of the project ensures that the project does not go off on a tangent.

Think Break 4.1

Evolution of the product proposition: outside input

In the development from the original 'product ideas names' to the product proposition, as shown in Figure 4.1, study where other people involved in the development and launching of the new product, such as consumers, distributors, retailers, advertising agency, media companies and the general public could be brought in to help the development. Add another column to Figure 4.1, labelled 'most important participants outside the company' and add the titles of the participants.

4.2 Product idea concept development

The product idea concept is first developed from market and consumer research but with consideration of the technical aspects of the product. Usually, it is a combination of internal company information searching combined with consumer or, in industrial marketing, customer discussion groups. In industrial product development, it has been shown that selecting the most innovative customers for product concept development reduces the time and improves the product concepts. The product idea concept research leads to a more detailed description of the product ideas and also includes screening of the ideas.

The consumer discussion panel, or as it is usually called the *consumer focus group*, is invaluable for building up the product concept. About 30-60 consumers can take part in small discussion groups of 6-8 people. They are given simple descriptions of the product ideas and are allowed free rein in their discussions. The consumers discuss their own attitudes and behaviour towards the products and identify their needs and wants in the products.

The product idea concept developed after the discussions details the '*benefits*' that the consumers want from the product. These 'benefits' can be divided into four types - basic product benefits, package benefits, use benefits, psychological benefits:

- ***Basic product benefits*** include physical characteristics (such as size, shape, colour), chemical composition, sensory qualities, nutritional value and safety features.
- ***Package benefits*** include price, value for money, ease of storage, use and disposal.
- ***Use benefits*** include convenience in buying and carrying, information on use, easy preparation, attractive presentation, recipes and nutritional information.
- ***Psychological benefits*** include prestige, fun and friendliness, aesthetics, healthiness.

When writing product idea concepts for use in further consumer panels or consumer surveys to build up the product concept, there are five things to remember:

- ***Be brief.*** Present a picture of the product, with no technical details.
- ***Use simple, everyday language.*** Use attractive, interesting and lively descriptions to keep the consumer interested.
- ***Start with the product category.*** Pinpoint the kind of product with the first few words of the description.
- ***Give a true picture of the product.*** State and do not exaggerate the product qualities. The idea product concept should be both believable and realistic.
- ***Describe the product's reason.*** Describe the uses and values of the product. Answer the consumer's question 'What is in it for me?' Show it has a useful and needed advantage over existing products.

In Example 4.1, a consumer focus group developed a product idea concept considering not only their sensory and convenience wants in the products, but also their health and safety needs.

Example 4.1 Development of product idea concept

A consumer focus group was given the following product idea description:

A new fruit salad topping to be used on ice-cream and other desserts.

The consumer focus group developed the following consumer product idea concept:

A natural, low calorie, fruit salad ice-cream topping containing real fruit pieces and no synthetic colours and flavours, to be used on ice-creams and desserts but also pancakes, breakfast cereals, bread and other baked products. It has the same viscosity as the present toppings, but has natural colours not strong synthetic looking colours.

It is packed in a 300 ml 'squeeze' plastic container, and the price is \$1-\$1.50. It is bought by families/households and is generally available from the refrigerator.

Think Break 4.2

Development of a product idea concept: chocolate bar

A product idea description is 'a crunchy white chocolate bar'.

Develop this into a product concept using Figure 4.2 by using market and technical sources, and assuming that the consumers are your peer group.

4.3 Product concept building

To build up the product concept, the important product characteristics are identified by the consumers, then the descriptions and if possible the 'strengths' of the product characteristics are determined. The product characteristics and their strengths are combined in a product profile.

4.3.1 Product profile

First the important product characteristics (the consumer product benefits) are identified by the consumer. The sensory properties are usually important to the consumer and there is often an emphasis on the sensory characteristics in building up the product profile as they are directly related to design. For Madeira cake (a sweet plain, rectangular cake, soft texture, cut into slices), the important characteristics were

identified as colour, taste/flavour, moistness and crumbliness. But there are other benefits to the consumer in buying a Madeira cake: the size, the packaging, the storage life, the availability to produce it quickly for a visitor. Consumers may not consider the nutritional value of a Madeira cake, but this is an important characteristic for many other foods. A checklist of general product benefits is useful as a reference during the consumer focus group discussion.

4.3.2 The ideal product profile

The ideal product profile is developed by the consumers, based on the most important product characteristics. In ideal product profile tests, the consumers study the competitive products and/or the product prototypes, and for each product characteristic score the test products on a scale from low to high. Then they place their scores for their ideal product (I) on the same scales. The ideal product profile gives a quantitative measure for each product characteristic which can be built up to the product design specifications. Part of the building of a product profile for orange juice is shown in Example 4.2.

Example 4.2 The building of a product profile for orange juice

The consumers in a consumer focus group were asked to:

- visually examine and taste three competing brands of orange juice;
- identify the product characteristics in their own words;
- discuss these characteristics among themselves;
- decide the most important characteristics;
- score each of the three orange juices on the scales for the important characteristics; (scales went from low (or weak) to high (or strong) on a 7 point scale).
- mark the scores for their ideal orange juice on the scales of the important characteristics.

The three brands of orange juice were Sweet Orange (SO), Perfect Fruit (PF) and Natural Juice (NJ).

The mean scores of the three orange juices and the ideal orange juice (I) for some product characteristics were:

	<i>Low</i>						<i>High</i>
	1	2	3	4	5	6	7
<i>Colour:</i> pale yellow/bright orange	:	NJ: I	:	PF : SO	:	:	:
<i>Colour:</i> natural/very synthetic	:	I	:	NJ : PF	:	SO:	:
<i>Thickness:</i> watery/syrupy	:	:	SO : NJ	I	:	PF :	:
<i>Pulpiness:</i> little/lots	:	:	PF SO : NJ	I :	:	:	:
<i>Sweetness:</i> not sweet/very sweet	:	:	NJ	:	I	:	PF : SO :
<i>Sourness:</i> not sour/very sour	:	:	SO	:	I	:	NJ : PF :

The Natural Juice was similar to the Ideal, slightly more synthetic colour, less sweet and more sourness. Perfect Fruit and Sweet Orange were brighter orange, less pulpy and sweeter. But the Ideal was between Perfect Fruit and Sweet Orange for thickness and sourness – Sweet Orange too watery and Perfect Fruit too syrupy, Sweet Orange lacking sourness and Perfect Fruit too sour. So one can see how this comparison has defined the product characteristics wanted by the consumer.

Think Break 4.3

Building a product profile: orange juice

To the product profile in Example 4.2, add two more sensory characteristics that you think are important for orange juice and describe their lows and highs.

What benefits can you identify under packaging, nutritional value, use and safety that the consumer might want in orange juice? What are the most important?

Write low and high descriptions of the scales for these important benefits, for example low/high vitamin C, dull/crazy.

Ask some friends to score three juices on the scales and place their ideal products.

4.4 Product concept evaluation

In product concept evaluation, several product concepts are evaluated and screened to find the most suitable product concept. The product concepts can be evaluated by consumers to see which they identify as winners and losers, and also by the company personnel to see which can be processed and marketed, and which has the highest predicted sales potential and profit or/and market share. Initial predictions of costs, prices and sales have a wide range at this stage but do give some indication of possible profits. Market share for a new product in an established market can be predicted from the market shares of the competing products in the present market, but obviously an innovative product in a new market is hard to predict. As predictions are inaccurate; pessimistic, most likely and optimistic predictions are made.

The consumer studies can be either a series of focus groups or a consumer survey. Not only do the consumers indicate their acceptance of the different products, but also their prediction of buying at different prices. They also need to compare the products with the

competitive products and identify advantages and disadvantages in the new product concept. The product concepts can be presented as descriptions, drawings, computer sketches and as prototype products, depending on the availability and suitability for the product of the different forms. It is useful to give the consumers a number of product concepts so that they can compare them and then patterns of acceptance can be ascertained. It is important that the questions asked help to sort out the product concepts, preferably in a quantitative way. The following are among the questions to be considered in planning a product concept evaluation by consumers:

Consumers:

- Users/non-users of this type of product or of the company brand?
- Representative of the general population or the market segment?
- Statistically representative of the market or not?
- How many consumers - 30, 60, 200?

Product:

- One product prototype or a group of product prototypes?
- Packaging and the brand included?

Method:

- Do the consumers choose the product they prefer?
- Do the consumers select the product they will buy?
- Do the consumers score the product characteristics for each product?
- Do the consumers assess the product accessibility, price, package size, retailer?

Scoring by the consumers of the product characteristics in a product profile for a number of prototypes and their ideal product gives the designer a greater understanding of the product for further development. A simple product preference does not give clear directions.

Technical and marketing groups also evaluate the product concepts for their suitability for production and for the market, using some of the checklist or probability screening methods as described in Chapter 3.

Think Break 4.4

Product concept evaluation: snacking products

Select one of the following pairs of new snacking products:

- ice-cream novelty on a stick / a flavoured milk, for children;
 - snack bar made from muesli / smoked chicken sausage, for adults.
1. Write product idea descriptions for the two products.
 2. Then organise a suitable consumer focus group and build up the two product idea concepts. Ask the consumers to rate the product idea concepts on a hedonic (liking) scale from dislike extremely to like extremely, with a centre point of neither like or dislike. Select the most preferred product idea.
 3. For the preferred product, organise a consumer focus group and give them two or three competing products to study. Ask them to list the benefits and characteristics they see in the products, and then ask them to rank these from most important to least important.
 4. Using the most important of these product characteristics build up a product profile. Ask the consumers to score the competing products and the new product idea concepts on the scales, and finally to score their ideal product.

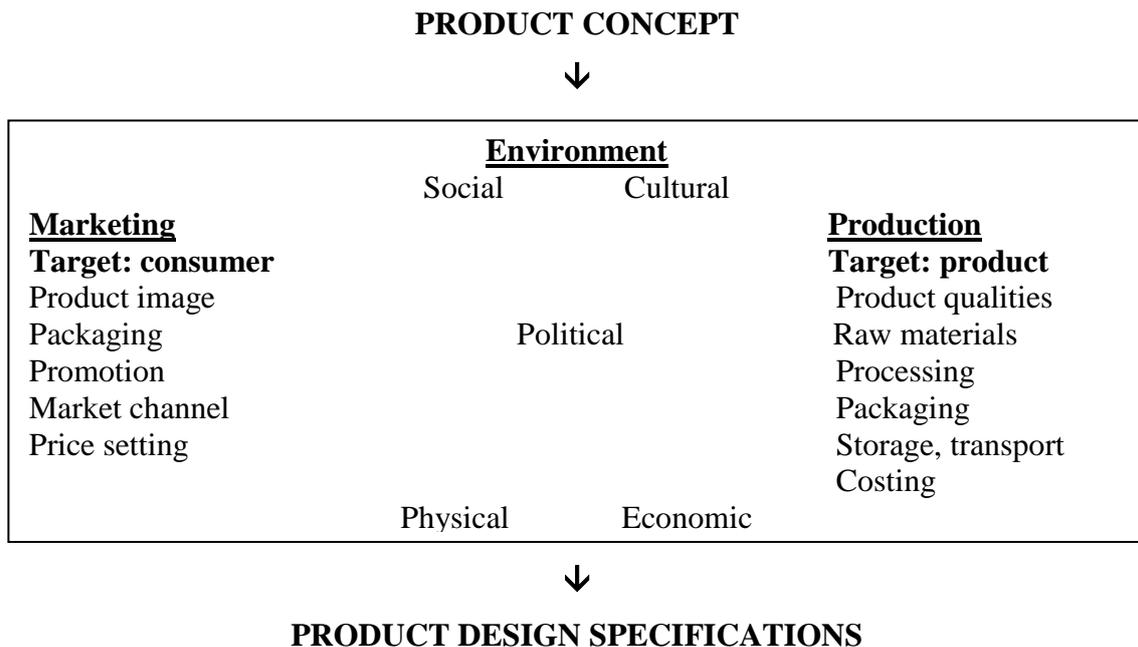
If it is not possible to organise a consumer panel, work through the adult products assuming you are the consumer.

4.5 Product concept engineering

In most industries, design specifications are usually set before the design process starts; yet in the food industry, the food technologists often plunge into formulation and process development before considering the characteristics desired in the product and there are seldom any quantitative product design specifications. Product design is not an easy task if the information that the designer is given are a set of constraints and a few ideas (often vague and definitely not quantitative) from consumers or the marketers. Before embarking on the design of a new product or the modification of a product, it is important that clear concise product design specifications are set so that a specific product can be developed.

Product concept engineering is the interpretation of consumer needs and wants into technical terms. The target product is identified in the product concept and product profile; the target consumers are identified together with their needs, wants and attitudes in buying, carrying, preparing, eating and disposing of wastes. Based on the target consumer and the target product, a quantitative design specification is developed with quantitative values for product characteristics if possible. Product design specifications in other industries call the quantitative descriptions *metrics*, and product target values are set for each metric. In the food industry, they are usually called product quality standards. It is often useful to define the marginally acceptable target values for consumer satisfaction, so that the design parameters are not too tight but are set within a defined range. Metrics also aid comparison with competing products. Three important areas for research activities are production, marketing and environment, as shown in Figure 4.3.

Figure 4.3 From product concept to product design specification



A great deal of technical information is needed to change the product concept into product design specifications - on product qualities, raw materials, processing variables, storage variables, packaging, marketing. Basically in today's product development we are changing the old cooking standards into technological specifications.

4.5.1 Product qualities

Product qualities, which are technically recognised and can be measured, are generated from the consumer product concept. There is a basic quality and a basic use for a product that need to be set as crucial quality specifications. The consumers want a high protein food and that is changed into, say, >10% protein; they want a pale pink colour and that is changed into a reading on a colorimeter; they want a crisp texture and that is changed to a force measured by a texture meter. Today there are more and more correlations between consumer sensory scores and machine measurements, so that these quantitative standards are more easily set. But sometimes it is not possible for the product characteristics and the ideal sensory scores to be converted into measurable product qualities, so sensory panels are trained to measure the sensory characteristics.

Product specifications are set for chemical composition, nutritional value and physical properties such as size, appearance and viscosity; as well as microbiological standards, safety standards and standards for price and sensory properties. It is important in setting standards that they agree with legal standards and that consideration is also taken of ethical standards expected by the consumers and the society.

An important product quality for design of other manufactured products is the aesthetic or artistic quality, for example the designer of a chair or an electric toaster relates the design to the prevailing art of the time. But art is seldom discussed in food design. This is now changing because consumers are becoming tired of bland processed foods. Food design is slowly becoming part of product design and accepting the general principles of design; therefore in setting the product quality, more consideration is being given to the current trends in design and how the food aesthetics can be developed to create the most desirable image.

The product quality standards (metrics) are written out clearly, showing the optimum level for each product characteristic and the limits of divergence from this that the consumers will tolerate. Sometimes the consumer will accept quite wide variations in the product quality and still rate the product as acceptable. The product quality standards must of course agree with any legal regulations that apply and with defined company policy.

4.5.2 Raw materials

The raw materials are identified which can be used and are available, and the limits on their use are obtained. The desired quality is related to the product quality standards. For example, if the product is to contain 5% protein, then it is necessary to know the protein content of the raw materials; if the colour is to be an orange/red, then the colouring ingredient must contain that type of red, perhaps defined by standard reference colours or physical spectra. In raw materials' specifications, limits (both minimum and maximum) are set on the quality, for example the chemical composition and the microbiological counts. There are limits on the quantities of raw materials in a formulation arising from processing needs, product structure needs, product properties, the quantity of raw materials available and the cost. In bread, there is a minimum amount of wheat flour needed to give the required amount of gluten in the structure. Cost of raw materials is important because the product will be in a certain price range and it is important to recognise this before the design starts so the design may be formulated to meet it. The origins of the raw materials also need to be noted, as required often by regulations.

4.5.3 Processing variables

Product formulation is essentially the selection of a blend of raw materials to give the desired product qualities, but the processing conditions will affect the transformation of the raw materials and therefore determine the final product. Formulation cannot be divorced from the process. Food formulations are often developed on the bench top using small-scale household equipment, and when this formulation is transferred into the process the results can be very different. Not only the types of processing but the conditions of processing need to be identified early in development. It is important that the processing variables and their limits are set at the conditions to be expected in the plant before product design starts.

Processing variables are identified together with their predicted limits. The important variables that affect the product quality, particularly safety, sensory quality and nutritional value, need to be studied so that limits can be set for them in the process. For example, the heat treatment required to sterilise the food needs to be quantified, i.e. the lower limits for time and temperature, but upper limits need to be set to reduce the deterioration of the colour and flavour of the food. It is important to understand the effect of the processing variables on the reactions causing changes in the food materials

during processing and how changes in the processing variables affects the rates of change in the food.

4.5.4. Storage and transport variables

These are defined because a food is not like a button or a bolt which only changes slowly over time; a food is continuously changing, sometimes very fast, depending on the conditions. The aim of food preservation is to keep the food within the acceptable quality range for as long as possible; this duration is the shelf-life of the food. Shelf life of the food is affected by the conditions of storage - the temperature, humidity, time, atmosphere, packaging. The desired shelf life, the method of deterioration and the storage/transport conditions are specified at the outset of the design. The transport method (road, rail, sea, air), the transport conditions (time, temperature, humidity, vibration, handling, costs), the storage (ambient, chilled, frozen) and the storage conditions (time, temperature, humidity, handling, costs) have all to be considered. Again costs can be a restriction, and they need to be in the design specifications.

4.5.5 Packaging

Packaging is based on either the consumer's or the industrial customer's needs and their uses of the food product, but it must also protect the product, fit into the processing and packaging lines, and meet the cost criteria. There may also be promotional needs for the packaging, and although during commercialisation, the final aesthetic design is completed, the needs of marketing have to be considered in the early design. For the product design specifications, the first factors to consider are the consumers' needs for the packaging and the preservation of the food by the packaging. For example, if the food is to be heat sterilised in the pack, then a can or a retortable pouch is the only packaging. If the consumer wants to heat the food in the container, this limits the types of materials that can be used.

Often packaging types and packaging methods are limited by the packing line, the costs and the availability of the packaging. For example, polyethylene may be the only film available at the price; only a pasteurisation packaging system may be available and not a UHT (ultra high temperature) sterilisation packaging system. These restrictions need to be identified before the design starts.

4.5.6 Marketing

Marketing is defined by the market segment(s) and the marketing methods to be employed, including the market channel, the desired promotion and promotional methods and of course the price. The product design can be affected by the type of retail display, the retailers' needs for the product and certainly the price range. The market and marketing specifications to consider are the market channel (retail outlets, wholesalers, agents, product flow), the market channel requirements (size, weight, availability, price, display information), the promotional method (TV; radio, newspapers, magazines, sampling) and the promotional message (exciting, new, sophisticated, natural, nutritional, low calorie). In particular, there is a need to define the image that the product is to have in the market and to the consumer, and also the promotion of this image by the packaging.

Study of competing products is important in setting the product's position in the market and in determining the possible price range. The positioning of the product against competing products needs to be specified so that the designer can appreciate the product characteristics needed. Also the prices, margins and discounts in the market need to be studied so that a price range for the new product can be set.

4.5.7 Legal requirements

Any legal requirements for the product, packaging, processing and marketing need to be carefully researched and specified. There are many legal regulations for product standards, which vary from country to country and also change with time, so these must be checked carefully during the development of the product specifications. There can be TQM and HACCP requirements for the processing, and nearly always Food Hygiene standards. There may also be limits and sometimes bans for raw materials and product movement into and out of a country, and often duties which affect the costs and prices.

4.5.8 Summary of product concept engineering

In product concept engineering and the building up of the product design specifications, it is useful to have a checklist to see that important factors are considered in all projects. There are usually similar conditions in many product development projects in a company unless the project is aiming at an innovation completely new in all aspects to the company, or a new product platform. Usually the production equipment, the distribution method and the market channels remain the same and so follow standard

specifications. New specifications are only developed for specific aspects of the project, usually the product qualities, but it is always important to check the standard specifications as they do change with time. Products that are major innovations will require extra consideration especially of their novel features.

In studying marketing and the consumer, there is always a need to watch any changes that may be occurring, particularly any long-term consumer changes as described for consumers in Denmark in Case Study 4. Such changes can be seen in many markets where consumers are switching from traditional foods to products that are more international in orientation.

Case Study 4.

Consumers' Desires for Change in Denmark

Clearly, there is a change in dietary patterns and consumer consciousness from generation to generation. The generation that ate porridge has now almost died out. The generation whose diet consisted mainly of Danish dishes, such as 'boller i karry' (a dish with meatballs and spiced with curry), meat, potatoes and gravy, and skibberlabskovs, is still going strong, but is otherwise much like the older generation. The generation that has been inspired by foreign food traditions and which eats a lot more pasta and pizza is now passing its dietary pattern onto the next generation. The cultural modernisation processes are emancipating the consumer from 'old traditions' and give the consumer the freedom to acquire new food habits and new knowledge about how to cook. Future consumers will be more aware of the environmental considerations of food production and the health value of products. They will again eat more vegetables and less meat, and they will pay more attention to the fat content. Consumers have grown used to the fact that the market is no longer confined to the local hinterland, with the relatively few products it can offer, but now embraces the whole world. While this has made some consumers worry about the growing energy and environmental implications, there is nothing to indicate that the tendency is going into reverse again. Last, but not least, the new consumer will find the quickest and most direct way of making his/her influence felt - perhaps as a political consumer!

(Source: Land, B. (1998) Consumers' Dietary Patterns and Desires for Changes Working paper No.31, MAPP (Centre for Market Surveillance, Research and Strategy for the Food Sector), Aarhus School of Business, Aarhus, Denmark)

Think Break 4.5

Product concept engineering – snacking products

Using the product concept you developed in *Think Break 4.4*, develop product design specifications using Figure 4.3.

How has this use of product concept engineering improved the basis for the product design?

What do you think are the advantages and disadvantages of increasing the application of product concept engineering in the food industry?

4.6 Product design specifications

In summary, a general outline for a product design specification is as follows:

1. Product concept: general statement on the product
2. Product qualities
3. Target consumers
4. Production design specifications:
 - Raw materials/ingredients
 - Processing/formulation
 - Packaging
 - Storage, transport
5. Marketing design specifications:
 - Packaging
 - Promotion
 - Market channel
 - Price setting
 - Competition
6. Environment:
 - Social
 - Cultural
 - Legal
 - Economic
 - Physical
7. Costs:
 - Production
 - Marketing

In some industries this outline is called the *product design brief*.

In the first attempt at the product design specification all this information may not be available. The product design specification develops as more information is obtained and the first prototypes are developed in 'ball park' experiments. There is no specific time in the PD Process by which the product design specification has to be completed - it depends on the type of product and the company, but it should be at or before the early stages of product design. When the product design specification is completed and agreed by all the different people in the PD project, including the top management, then it should be signed by all involved to show their commitment and responsibility. If major changes are made during the design procedure, then there needs to be a meeting of all concerned to ensure agreement on the changes. Example 4.3 is an example of a product design specification for vegetable-based frankfurters.

Example 4.3 Product design specifications: vegetarian sausages

1. Product Concept General Statement

A meatless frankfurter type product, similar to the meat sausage with respect to flavour, slightly smoked and mildly spiced; it has a long slender profile typical of a frankfurter sausage. The product is packed in a retortable pouch and can be stored at ambient temperatures. It is targeted at the vegetarian market segment specifically, yet is acceptable to the general market. It incorporates non-meat source proteins, fats and stabilisers, and is a protein/fat emulsion extruded into non-animal casings.

2. Product Qualities

Nutritional: high in protein and low in saturated fats and cholesterol.

Sensory: similar flavour, colour and texture to a meat frankfurter, slightly smoked and mildly spiced. Outer skin brown/orange in colour; inner matrix light pink.

Physical: a long, slender sausage shape, a 'meat like' emulsion matrix.

Chemical: meets with the legal chemical composition for sausages, no preservatives.

Microbiological: microbiologically stable, ensuring up to eight months' stability at ambient conditions. Free from *Coliforms* and *Salmonella*.

Processing: produces a stable protein/fat emulsion.

Storage: shelf stable under ambient conditions for eight months.

Packaging: pouch contains six sausages, weighs 250 g.

Price: \$2.2 to \$2.5 per 250 g pack.

3. Target Consumer

The target consumer is the vegetarian segment, as well as health conscious and innovative consumers in the general market. The main additional consumer benefit is the convenience factor of not requiring refrigeration. This could be attractive to outdoor enthusiasts such as hikers and campers. Promote ambient stability and transportability of pouch.

Example 4.3 Product design specifications, continued

Production design specifications

4. Proposed ingredients and their functions

<i>Ingredient</i>	<i>Function</i>
1. Wheat gluten	Thermal gelation - texture and structure
2. Whey protein	Thermal gelation - texture and structure
3. Hydrogenated vegetable oils	Dispersed phase - mouthfeel and texture
4. Torula yeast	Flavour and texture
5. Hydrolysed vegetable protein	Flavour
6. Onion and garlic powders	Flavour
7. Salt	Flavour
8. Flavours	Flavour
9. Water (potable)	Mouth feel, texture and structure

5. Process

This is a new process for the company and there is no equipment available. A complete process could be bought from an equipment company, or the canning line could be adapted with the purchase of a filling line, or the company could design a new process. A sterilisation process is used, but the times and temperatures needed are not known.

6. Formulation: not known at present time.

7. Packaging

Preformed retortable pouches. Vacuum-sealed retorted pouches packed in corrugated cardboard cartons, holding approximately 24 packs of six sausages (6 kg).

8. Government regulations: not known at present time.

9. Marketing design specifications

Distribution: distributed through the present ambient physical distribution system, mainly to supermarkets, but also to specialty health shops.

Price: price per dozen 250 g packs is approximately consumer price \$27.00, list price \$23 ±10%, net wholesale price \$18.

Promotion: directed to the general market as well as the vegetarian market segment. Emphasis is directed to supermarkets, delicatessens, and health food shops, in that order of priority.

Attributes to be promoted: no meat, no refrigeration needed, no preservatives, low levels of saturated fats/high protein status, no cholesterol.

Initial competition: slight; if the market should develop well, competitors are almost inevitable.

Think Break 4.6

Product design specifications: sign off

If you, as the product designer, were presented with these design specifications, what questions would you ask before agreeing to them?

Search for further information to answer your questions and complete the product specifications,

If you, as the top manager, were presented with the amended design specifications, for what further information would you ask before agreeing to them?

4.7 Summary

The development of the product concept and the product design specifications is an important stage in the product development project. These are filled out in as much detail as possible while still leaving room for creativity in design. They are formally agreed by all the participants so that there is no opportunity halfway through or even at the end of the design for someone to say 'that is not what I meant'. This avoids redoing of the design procedure, which is so costly in time and money, is frustrating to all, and often leads to a very confused commercialisation.

The product concept summarises the consumers' needs and wants in a quantitative way through the product profile. There should if practicable be a study of the first prototypes by consumers so that as realistic a picture as possible is built up. These prototypes should display controlled variations of the product characteristics.

The product design specifications are built up by using product concept engineering, in which the consumer, the product, marketing and production are studied together to give quantitative descriptions of the product qualities, raw materials, processing conditions, storage life, pricing, promotion and distribution. At the first attempt, the specifications may be rather vague in some areas and information needs to be collected during the design to make them more specific. At the end of the design process, the product specifications for production and the strategy for marketing are in place.

4.8 Suggested readings

Herstatt, C. and Von Hippel, E. (1992) 'From experience: developing new product concepts via the lead user method', *Journal of Product Innovation Management*, 9, 213-21.

Hofmeister, K.R. (1991)'Quality function deployment: market success through customer driven products', Graf, E. and Saguy I.S. (eds.), *Food Product Development, From Concept to Market Place*, New York: Van Nostrand Reinhold, pp. 189-210.

Meyer, R.S. (1984) 'Eleven stages of successful new product development', *Food Technology* 38(6), 71-8, 98.

Moskowitz, H.R. (1994) *Food Concepts and Products, Just-in-time Development*, Trumbull, Conn.: Food and Nutrition Press, pp. 1-69.

Ulrich, K.T. and Eppinger, S.D. (1995) *Product Design and Development*, New York: McGraw-Hill, pp. 33-75.

Some more recent readings

Bogue, J. and Sorenson, D. (2008) 'Consumer research in the early stages of New Product Development- market-oriented development of meal complement beverages.' Earle, M. and Earle, R. (eds.) *Case Studies in Food Product Development*, Cambridge, Woodhead Publishing Ltd. pp 277-300.

Brunso, K. and Grunert, K.G. (2007) 'Consumer attitude measures and food product development'. MacFie, H. (ed.) *Consumer-led Food Product Development*, Cambridge, Woodhead Publishing Ltd. pp 197-222.

Earle, M., Earle R. And Anderson, A. (2001) 'The knowledge base for product development'. *Food Product Development*, Cambridge, Woodhead Publishing Ltd. pp 149-193.

Fuller, G.W. (2005) *New Food Product Development*, 2nd. Ed., Boca Raton, Florida, CRC Press. pp 208 –218

Wesselingh, J.A., Kill, S.& Vigild, M.E. (2007)'Lesson 8, Select a Concept' in *Design and Development of Biological, Food and Pharmaceutical Products*, Chichester, England: John Wiley & Sons Ltd.

Project Break 4.

For either your own project or Project 4 at the end of the chapter:

- Develop the product concepts for the **two product ideas**.
- Evaluate these product concepts according to consumer, marketing and technical needs.

Ask some technical people in the company to rate these two product concepts on important factors such as raw material availability; ease of processing, shelf life, predicted costs of the products. Ask the marketing people to rate the product concepts according to what they see as the important marketing factors: suitability for retailers, ease of promotion, advertising strength, price. Ask the marketing and the technical people to predict the market and the possible sales.

- With all this information, select the product most suitable for further development.
- For this product, develop the product design specifications from the product concept.

You need to collect information on the type of product, the way in which it will be used, the people who will buy it, the people who will eat it, the market where it will be sold and the ways it might be processed and packed. The most economical methods should be used for this research, which is mainly desk research within the company and also external published information.

For technical information, the sources of information are company processing and raw material records, textbooks, review articles and appropriate web sites.

For marketing information, the company records and industry information is used, and there may also be commercial and government statistics.

Project 4: The New Era for Dried Vegetables

Modern dried foods have been on the British market for over fifty years, starting with chicken noodle soup and leading to the wide variety of soups, gravies, sauces, snacks and meals available. Consumer demand for healthy, fresh-like and convenient food is putting some pressure on the manufacturers to improve the quality of these products. Consumer demand has increased for processed products that retain their original characteristics. In industrial terms, this requires the development of operations that minimise the adverse effects of processing. In food drying, there is a loss of volatiles and flavours, changes in colour and texture and a decrease in nutritional value. Furthermore, residual enzyme activity and microbial activity in dried foods affect product quality during storage and the length of the storage life. Microwave drying is a new process which is starting to be used in the food industry worldwide, mostly for the drying of pasta and post-baking of biscuits. Microwave drying of fruit and vegetables is developing, and is used industrially in the UK.

A company has been investigating the use of microwave drying in preparing flavouring materials such as mushrooms and peppers, and have produced ideas for two products:

- A mix of dried green peppers, tomatoes and garlic which can be sprinkled on salads, for consumers who eat fresh foods. The peppers and tomatoes are chopped.
- A dry tomato/mushroom sauce which can be mixed with cold water. The tomatoes and mushrooms are in small pieces. The cold sauce can be mixed with chopped cooked meats, chopped fresh vegetables or cold cooked pasta to give salad type meals.

Some of the general flavour/aroma characteristics of dried green peppers, tomatoes and garlic that have been identified are: fruity/fresh, sweet, sour, grassy, cucumber, earthy, sharp. They also have specific tomato, mushroom and green pepper flavours and aromas. Texture descriptions for dried vegetables have been juiciness, toughness.

(Reprinted from Nijhuis H.H., Torringa H.M., Muresan S., Yuksel D., Leguijt C. and Kloek W. (1998) 'Approaches to improving the quality of dried fruit and vegetables', *Trends in Food Science and Technology*, 9, 13-20 with permission from Elsevier Science.)

