3

The product development process

The PD Process coordinates the specific research activities such as product design, process development, engineering plant design, marketing strategy and design with the aim of producing an integrated approach to the development of new products. The overall aim is to create a product that an individual consumer or a food manufacturing company or a food service organisation will buy. The two parts of product development – the knowledge of the consumer's needs/wants and the knowledge of modern scientific discoveries and technological developments – are both equally important. The PD Process combines and applies the natural sciences with the social sciences to systematically produce innovation in industry.

The PD Process is a system of research for the individual product development project and the product development programme. It varies in detail from project to project but overall retains the same structure of four main stages, subdivided further into 7–9 stages in some product development models (Cooper, 1996; Earle, 1997). The four stages are product strategy, product design and process development, product commercialisation, product launch and evaluation. Between the four stages, there are critical evaluations and top management decisions on the project and the products, called stage gates (Cooper, 1990) or critical points (Earle, 1971). **Critical points** are an essential part of the PD Process. For the critical decisions to be made, certain knowledge has to be generated in the research – the **outcomes** from the various stages. To build this knowledge, specific research is needed – the **activities** of the various stages. The project teams choose different procedures for these activities – the **techniques** used in the activities. There are important interrelationships in the four main stages between:

Critical decisions +-- Outcomes +-- Activities +-- Techniques

This PD Process can be called the Critical PD Process because it is based around critical decisions, and because there is critical analysis of the activities/ techniques and the outcomes throughout the project.

3.1 Product strategy

Stage 1: product strategy, starts with the finalising of the product development strategy and product development programme. Then the aims of the individual product development projects can be set. The project starts with the generation of new product ideas and the outlining of the product design strategy, and ends with the product concept and product design specifications. There is real dichotomy in the decisions and activities; there is on the one hand, the need for freedom to be creative, and on the other, the need to set boundaries in the product design strategy. Before top management can make the critical decision to fund the further stages of the project, or to stop it, or to return it to the team for more knowledge, there are three critical decisions:

1. Is the product concept a unique product satisfying the needs and wants of the target consumer/customer?
2. Will the product concept and the project deliver the financial and other aims set in the business and product development strategies?
3. Does the product concept harmonise with the company's business and environment?

Top management, to make these decisions, needs knowledge on the processing, production, distribution and marketing technologies for the product. Knowledge will be incomplete at this time. The financial predictions (sales revenue, gross profits or margins, the probabilities for success, the returns on investments or break-even times), and future costs and time for the project are very approximate. There will be other specific requirements for each project, such as enhancing health (Ericson, 1997), environmental effects, food regulations and trade barriers. But of course the most important knowledge is the description of the product idea in the product concept and the product design specifications. The project team has to build up this knowledge throughout the stage, and the type of knowledge identified will determine the critical activities that have to be completed in the product development project (Earle and Earle, 1999). The knowledge is built up in substages and decisions are made at the end of each stage usually by product development management, but sometimes by top management if the project is a major innovation and costly.

The substages in Stage 1: product strategy for the individual project are:

- defining the project;
- developing the product concept;
- identification of processes, distribution and marketing;
- development of product design specifications;

- planning of the project;
- predictions of project costs and financial outcomes.

This is total technology research incorporating product, processing and market research with consumer and society studies. At this early stage, the knowledge may be generalised, and the aim is to make it greater in breadth and depth through the later stages of the project. This stage sets the direction for the product development project, and has been identified in much research as most important to the final success of the project.

3.1.1 Defining the project

The aim, outcomes and the constraints have been identified in the product development programme and presented to the product development team or manager for the project. But there is usually a need for further desk research by the team to determine the accuracy of the aim, outcomes and constraints and also to 'flesh them out' to give a more detailed project definition that can drive and control the project (Rosenau, 2000). This is also the time to select a suitable PD Process for the project and to set out an outline project plan.

There are four aspects of the initial research to define the project by developing more detailed aims: product ideas, consumers, technology and market as shown in Fig. 3.1. The research includes all aspects of the PD Process. At the same time the team is developing new product ideas, and relating them to the market possibility, to the technology possibility and to the product possibility. What are the products? Can they be made? Can they be sold? Who wants them? What do they need? These are the types of questions being discussed by the team and it is an important time for team interaction. This is only 'desk research' – using information in the company, outside records, published textbooks and papers, which are easily available. There is a maximum use of tacit knowledge within the group and within the company. Information technology has improved the storage and use of knowledge in product development, in particular the use of product models with a framework of raw materials, ingredients, packaging and production methods (Jonsdottir *et al*., 1998).

Think break

In a project, the aim was changed from:

Export a nutritional product to Thailand with a market size of $5 million.

to:

Export a protein product, minimum 20% protein, to the Thai middle class, urban market, marketed through gyms and supermarkets; processed in the spray drying plant or the UHT plant and distributed at ambient temperatures. It must have sales greater than $4 million.

1. Study the aims and discuss how the first aim has been improved in the second aim as a focus for the project.
2. How would you improve the second aim to make it clearer for all people in the project?

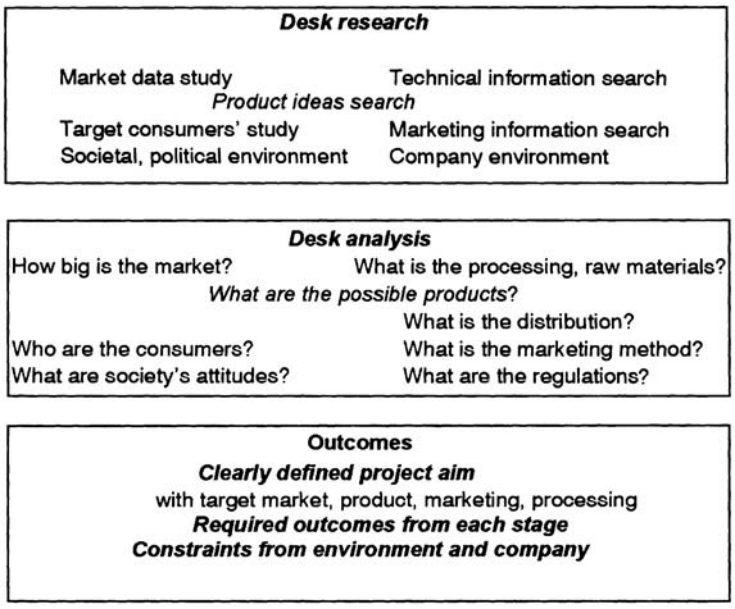


Fig. 3.1 Defining the project: activities, outcomes and constraints.

The second aim allows two different methods of processing. In other aims there may be two target markets, or two methods of marketing, as it is not clear at that time just which is the direction to go. Aims can be adjusted during the project but there must be agreed reasons for doing this.

The **outcomes** for the different stages of the PD Process are developed from the aim, the company's PD Process for this type of product, and the decisions that the top management has indicated for different times in the project. In particular the decisions identified are used to determine the outcomes as shown in Fig. 3.2. There are both product and project decisions to be made, the product decisions and outcomes are ovals in Fig. 3.2. The general decisions are similar for many projects but there will also be specific decisions for each project. Therefore other outcomes will be needed. It is important to recognise the decisions that have to be made, and by whom, and to then select the knowledge needed in the outcomes to make these decisions. Outcomes are sometimes called objectives; they are the knowledge goals that have to be reached at the end of the different stages of the PD Process. In some projects, especially large projects,

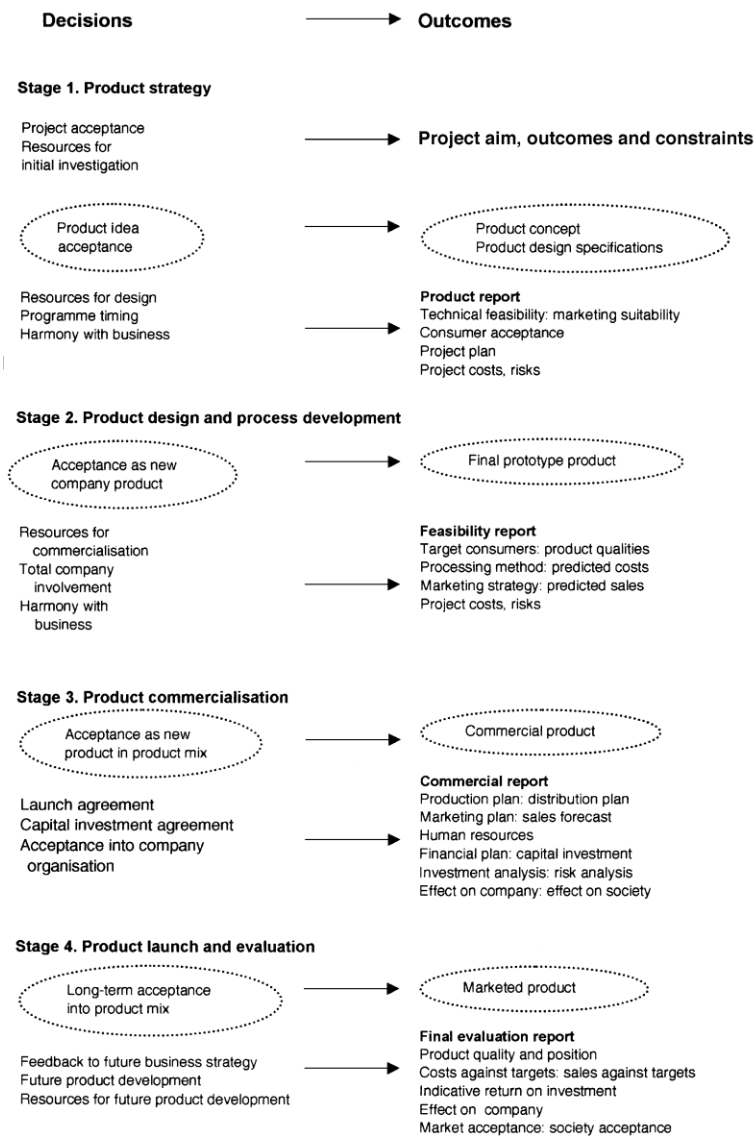


Fig. 3.2 Identifying the outcomes necessary for the decisions (After Earle amd Earle, 1999, by permission of Chadwick House Group Ltd).

critical decisions may be made more often in the project; again these decisions have to be recognised and the required outcomes defined.

It is important to select the outcomes by balancing the need for knowledge against the resources and time needed for the activities to give the outcomes. With the recent emphasis on faster but quality product development, more attention is being paid to selection of outcomes. The choice of outcomes and

therefore of project activities depends on the risk of failure the company is prepared to take. Teams often seek extensive knowledge so that they are surer of the whole picture, but this can be expensive and take too long and even sometimes result in failure. There is history of some companies seeking too much information in the test markets, and being overtaken by other companies. Outcomes that are fundamental to the project and whose completion is necessary for the project are always included. Identifying possible outcomes at the beginning of the project and selecting the critical outcomes for the company and its environment, which are within the money and time the company is willing to provide, ensure a project that is efficient and effective.

The **constraints** are any factors defining the area of the project. Some of these, such as financial resources and time for launching, will have been specified in the product development programme. At this time it is important to identify constraints on the product, processing and marketing, and also the constraints placed by the company and by the social and political environment. For example, the constraints from the food regulations and from society's attitudes to production, processing, food additives and safety need to be identified before product design starts. There are sometimes constraints caused by the availability of people and equipment. A checklist for studying constraints is shown in Table 3.1.

The constraints need to be recognised but they must not be too tight as this could stifle the creativity in product design and process development. For example, specifying the protein level as exactly 20% for a perceived consumer need and not a requirement of the regulations could restrict the other product characteristics. But a protein range of 20–30% could satisfy the consumer but allow more freedom in design. It is important to criticise the constraints – are they all needed, are they too tight? Sometimes a company constraint may stifle the project, and it is important to revisit it with management to see if it can be changed.

The aim(s), outcomes and constraints direct and control the project. They are used as factors in screening and evaluating the product ideas and product concepts, and then in evaluating the different prototype products. They are the

Table 3.1 Project constraints: a checklist for product development projects

Product	Processing	Marketing	Financial	Company	Environment
Eating quality	Equipment	Channels	Fixed capital	Strategy	Local government
Composition	Capacity	Distribution	Working capital	Structure	National government
Nutrition	Raw materials	Prices	Investment	Expertise	Industry agreements
Packaging	Wastes	Promotion	Project finance	Location	Farmers' agreements
Shelf life	Energy	Competitors	Cash flows	Management	Economic status
Use	Water	Size	Profits	Innovation	Business cycle
Safety	Personnel	Product mix	Returns	Size	Social restrictions

Source: From Earle and Earle, 1999, by permission of Chadwick House Group Ltd.

basis for identifying the activities and choosing suitable techniques and for the project plan, which directs and controls the process.

The **outline project plan** is based on the PD Process selected for the project and the outcomes identified. The PD Process varies according to the type of product – industrial, consumer and food service, and also whether the product is incremental or a major innovation. The activities are selected to give the outcomes previously identified. Choice of activities is not only determined by the knowledge needed in the related outcome, but also by the resources and time available. The **description of the activity** defines the outcome needed, the time frame to be met and the resources that can be used. The outline plan is set up so that everyone in the project can identify their place in the project and what they are aiming to achieve. They can start to select the techniques for their section of the project, particularly for the early stages.

Think break

In Chapter 3, we are going to do the initial stage of a PD project, either a project from your company or using the Case Study in Section 7.4. Obtain from the management of your company the general aim, constraints and resources for this project. In this Think Break, search for more information and develop the final aim(s), outcomes and constraints for management's approval.

1. What is the market type – consumer/retail, consumer/food service, business to business/industrial, business to business/food service? Identify the target market, its possible size, needs and competing products. Use Fig. 3.1 as a guide, try to find information to answer the market/consumer questions.
2. Identify the type of product development in the project – me-too, improvement, product line extension, innovation on the same product platform, a new platform; and also the type of market. Then select/design the PD Process.
3. Using Fig. 3.2, identify the possible decisions to be made and then discuss them with management. Select the final decisions.
4. Determine what knowledge is needed to make these decisions and then select the outcomes that are needed for the decisions at the various stages of the project.
5. What are the principal constraints already identified for this project – economic, physical, political, social? Now use the checklist in Table 3.1 to discover any other constraints that might be important. Rank the constraints from critical to not important and select the final constraints for the project.

3.1.2 Developing the product concept

The food industry has seldom used the word design except as related to packaging and to advertising. The development of the product has usually been called 'product development' and had connotations of laboratory formulation

and sensory panel. But today, there may be real benefits in adopting food product design and in associating food product design with other areas of design.

The product is an amalgam expected by the consumer of the hard values or the basic qualities and the soft values or the differentiating qualities such as aesthetic appearance and environmental friendliness. Product design, or the product creation process, is therefore an amalgamation of the disciplines of consumer and market research, technology and engineering research with design practice as shown in Fig. 3.3. Product design is an essential part of the product creation process in equal cooperation with engineers, marketers and consumer researchers (Blaich and Blaich, 1993). All come together in the technology of the product.

- Consumer researchers build the consumer/product relationship throughout the PD Process.
- The market researchers analyse markets and design the marketing and distribution methods in the market strategy.
- The food engineer and technologist research the product and the process together in co-engineering and design the production and physical distribution methods.
- The food product designer researches the social and cultural backgrounds and designs the holistic product.

It is important that these are all integrated from the beginning of the PD Process. As the product concept and the product design specifications are built up, all aspects are brought together; then as the project progresses, the people involved understand what is needed in the design of product, production and marketing to satisfy the consumers' needs, wants and behaviour.

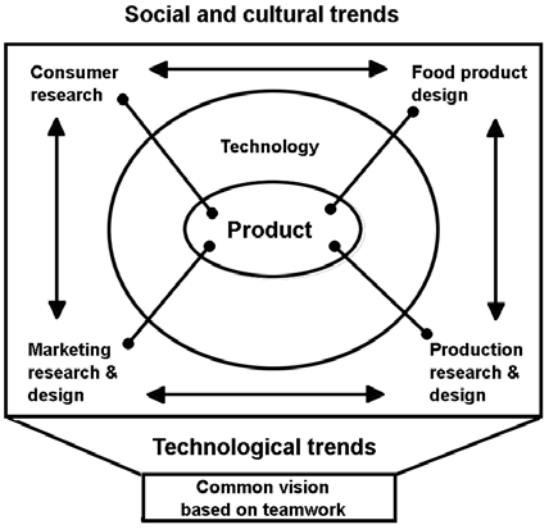


Fig. 3.3 Integrating the main disciplines in product creation (Source: After Blaich and Blaich, 1993).

The product design process is subject to a set of requirements (product design specification), including basic and desirable product functions, performance, aesthetics and cost (Dasgupta, 1996). This is common to many industrial areas but is now only becoming accepted in the food industry. Firstly, the consumers and product designers, very often with marketers, come together to develop a product concept, and then the technologists and engineers are brought in to develop the product design specification. Some of you may be thinking that this is sounding rather complicated, but actually you do it all the time but may be doing it without clear directions. Designers and the consumers have difficulty in working in the abstract and there is some design taking place either in drawings, computer descriptions or 'mock-up' products. Creativity starts here. It is a useless exercise for marketing to work alone with consumers to develop a product concept and then hand it to the food designer/technologist and say make this! That seldom leads to unique products. There needs to be cooperation among marketing, consumer and the product designers (or food technologists/ product developers as they are often called in the food industry).

The areas in building the product concept for design are (Ulrich and Eppinger, 1995):

- identifying consumer needs;
- establishing target product brief;
- analysis of competitive products;
- concept generation;
- concept selection.

The project team works between these areas. Firstly they study consumers, trying to build their needs into more specific terms in the product brief, and at the same time studying the competing products. Then they go back to the consumers with more defined product types to generate specific product concepts. Finally they work the product concepts into more specific and detailed product descriptions and go back to the consumers to find their reactions.

The product concept progresses through the product development project from the original idea to the final product specifications controlling production and the final product proposition that is the basis for the marketing. It is refined and expanded in two different ways because of the different end uses – in a technical, quantitative description and in a consumer-based, in-depth, description as shown in Fig. 3.4.

The outcomes needed in the first stage are the design product concept and the design product specifications. These start from a name or a simple description in the product development programme, and firstly the team generates ideas for the product and then with consumers builds simple product idea concepts. After evaluation these are reduced to one or two product ideas, and research with consumers and the market gradually builds up the product concept for design. This is then integrated with the processing and marketing technologies, and the product concept is built up by product concept engineering into metric descriptions in the product design specification. The design product concept is

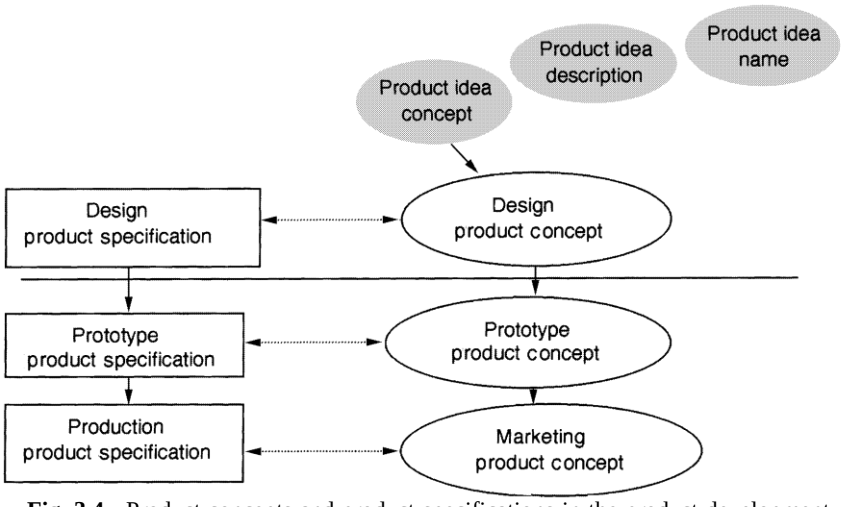


Fig. 3.4 Product concepts and product specifications in the product development project.

the consumer's description of the product and includes the product characteristics, benefits and position in the market as identified by the consumer. The design product specification is developed from the product concept with reference to the technical aspects of the product, processing and distribution. It is the precise definition of what the product has to do, it is metric and has a value (Ulrich and Eppinger, 1995).

A product has several layers and these are being built up gradually during the product development. There is the company's basic functional product, the total company product (with packaging, aesthetics, brand, price and advertising) and the consumer's product (which relates it to the competitors, the environment, the media, the society, as well as its communication and use) as shown in Fig. 3.5. There is a continuing interaction between these three layers of the food product, and therefore between the four groups of people – consumers, product designer, technical and marketing – during the development of the product concept and the product design specifications.

To research the products, there is a need to identify the following:

- **Product morphology**, the breakdown of a product into the specific characteristics (or attributes) that identify it to consumers or/and business customers. Determined by analysis of the product family and the individual product (Schaffner *et al*, 1998).
- **Product characteristics** (or attributes), the features identifying the product to the company, the market and the consumer. Identified by consumers and designers in the creation of the product concept.
- **Product benefits**, the product characteristics important to the consumer. Identified in the consumer/product designer discussion groups. The product benefits are in four main areas – basic product benefits, package benefits, use

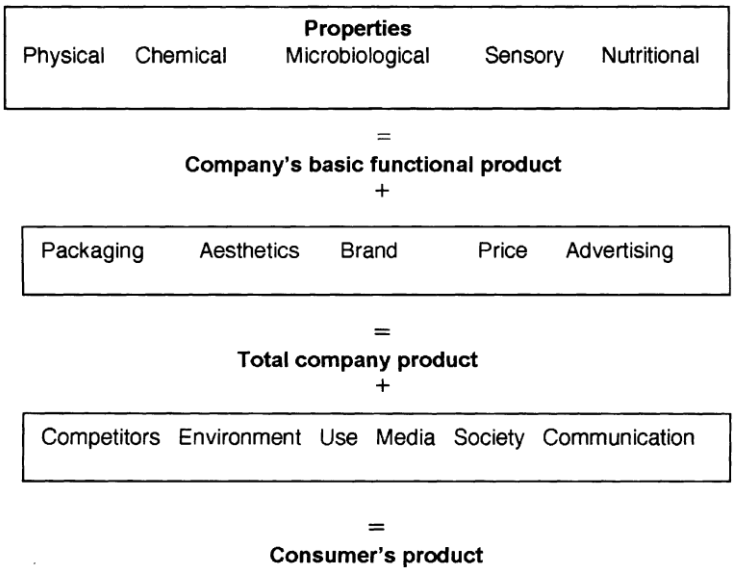


Fig. 3.5 The total food product (Source: From Schaffner, Schroder and Earle, *Food Marketing: An International Perspective*, © 1998, by permission of the McGraw-Hill Companies).

benefits and psychological benefits – and these need to be integrated into the final consumer preference.

- **Product profile**, the group of product characteristics which is the unique identification of the product – it is the product's DNA or fingerprint.

In developing a product strategy to introduce meat pies to Malaysia by a New Zealand company, the activity was to identify the product benefits required by Chinese and Malaysian consumers; three techniques were used – focus group, consumer survey, and multidimensional scaling (MDS) as shown in Table 3.2.

Table 3.2 Product benefits for meat pies in Malaysia

Multidimensional scaling*	Focus group[t]	Consumer survey*
Taste (sweet–savoury)	Convenience	Taste
Product type (bread–non-bread)	Freshness	Cleanliness
Origin of product (local–foreign)	Smell	Freshness
	Local flavour	Healthy (good for you)
	Healthiness	Convenient to obtain

* Chinese and Malay women in Malaysia.
[t] Malaysian students in New Zealand.

Source: After Lai, 1987.

The consumers compared the pie, particularly in the MDS, against the sweet and savoury baked/fried snacks already eaten in Malaysia. The MDS identified the main characteristics, and the focus group and the consumer survey identified general product benefits. To design the products more information was needed, and a sensory ideal product profile was identified by a small group of the consumers tasting the preliminary experimental products. The consumers' sensory characteristics were 7 for the pie top, 5 for the pie bottom and 14 for the pie filling. The five scales for the pastry bottom with the consumers' ideal scores are shown in Fig. 3.6.

The scales with their ideal points were included in the product design specification. The product profile needed to be analysed in two ways – what do the consumers mean by an ideal score of 5 for the pastry thickness? Can a physical measurement mimic this sensory characteristic? It is easy for thickness. Texture can also be measured in a physical instrument, but it may be necessary to train a panel to judge 'flour smell' and 'oiliness' unless a chemical test can be found for them.

The important product benefits may include the type of raw materials and processing, as in organic foods and environmentally friendly foods, as well as the recognised consumer concerns of nutrition, safety, eating qualities and the psychological benefits such as prestige and fun (Earle and Earle, 2000). There has been a concentration on sensory benefits as shown by the rapid development of sensory science but this needs to be made much wider to include all benefits. An example of a product concept strongly based on the psychological needs is described in Box 3.1, a product concept for pet foods.

The concept of the package often follows the more traditional path of industrial design, developing a product architecture that defines the major subsystems of the package such as the inner, outer, closure, seals. Product architecture can also be useful in building up products such as complete meals with various meat, vegetables and noodles in some type of display pack.

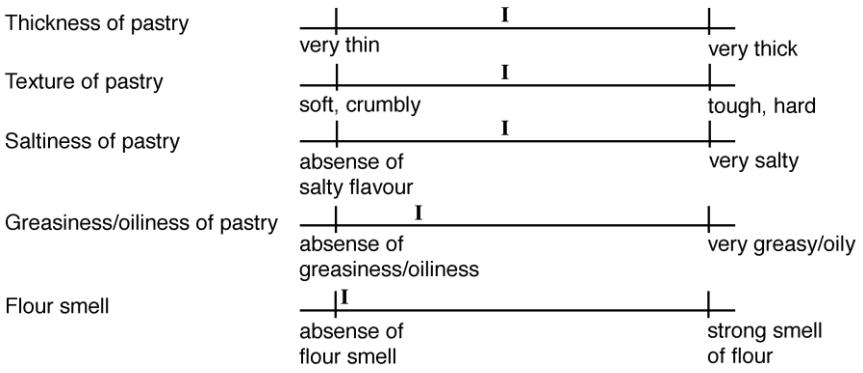


Fig. 3.6 A product profile for pastry (Source: After Lai, 1997).

Box 3.1 Four-legged trends

How many times have you seen a cat prey on a chicken or, heaven forbid, a turkey? But then cat food with blackbird or field mouse doesn't sound very discerning to a petfood shopper. Let there be no doubt that Britain's petfood shoppers are discerning and willing to show the colour of their money to satisfy their pet's taste buds.

The dominant trend over recent years has been the humanisation of petfood. Supermarkets stock an awesome display, encompassing not just a plethora of brands but also variants. A cosseted cat can start the day with a bowl of muesli and a splash of cat milk, enjoy chicken in jelly for lunch and perhaps have some tuna for supper. Meanwhile, the family dog can enjoy beef chunks at noon and 'a complete dry meal' to round off the day. In essence, the petfood sector has expanded to cater for owners' perceptions of what their pet requires. This is echoed in pack design.

In design terms, humanisation manifests itself by mimicking the same brand-building cues used for human brands. For example, Trix dog snacks bear a striking visual similarity to the human treat Minstrels, or equally they could be mistaken for a beef flavour packet of crisps. Similarly the packaging of Whiskas cat milk seems to draw inspiration from Carnation long-life milk. There is also a move towards injecting 'appetite appeal' into petfood packaging, with stylised displays of the product depicted on-pack. The use of expensive illustrations and top food photographers confirms this move. It has reached the point where the only difference between human and petfood packaging is the animal images on-pack.

The way forward for packaging design in the petfood sector is to aim for the right balance between traditional petfood brand values and those of the tinned food destined for human consumption. Yes, appetite appeal is a very important sales tool in this arena, but the trade-off shouldn't be a loss of whimsy and humour.

Source: From Petrie, 1995 by permission of *Marketing Week*, published by Centaur Communications (London).

Think break

For the project identified in the previous Think Break:

1. Generate five ideas for new products within the area of the aims.
2. Consider these product ideas against the aims and constraints for the product and choose the three most suitable products.

3. With some consumers build simple product idea concepts for these product ideas.
4. Expand the product idea concepts with knowledge of the processing, marketing and the technical characteristics of the product. Select the two most promising product idea concepts with the consumers.
5. Finally with the consumer group, build product concepts for design of the two remaining products.

3.1.3 Product design specification

Building the product design specification from the product concept includes both research and design. Market research provides more details about the target market characteristics and size, the methods of marketing that might be used and the position of the product as compared with the competitors. The market study is progressing into consumer and retailer surveys in consumer marketing and customer surveys in industrial marketing. The technical research involves the searching of the scientific and technological literature, including patents, as a preliminary investigation into the possible products, processing and physical distribution. The designer is starting to create the products and often needs to make models so that ideas on the product characteristics can develop. The modelling can be on paper or computer, and some preliminary laboratory research makes the products on a small scale. Of course in incremental development, the basic product is already known and both the marketing and the technical research, and product model building are much less and indeed may not be done at all.

The product design specification has for a long time played an important part in design in other industries and now is considered the area that has a major effect on quickening development and ensuring product success. The use of computer techniques such as CAD (computer aided design), CAID (computer aided industrial design), CAM (computer aided modelling), especially with more modern versions, has given the opportunity to design on the computer and to present the product ideas on the computer to other project members and even to consumers. The computer designs can be transferred into engineering design and linked to small-scale production units producing the experimental prototype for the consumer to discuss. Some of the newer tools in product design are shown in Table 3.3.

All of these new developments are changing industrial design and making it quicker. These techniques can be used for food packaging and for a structural food such as a loaf of bread and snacks. Snacks have already been designed using earlier CAD versions. Word descriptions of food product characteristics have been used in computer techniques such as conjoint analysis for a number of years to build and evaluate food product concepts (Moore *et al*., 1999). The question is how far can the food industry use computer design techniques in building up product concepts and product design specifications? Certainly the

Table 3.3 Tools at the cutting edge of product design

3D solid modelling software Describes both the exterior and interior of the product in three dimensions
Virtual-reality design tools Aid interaction of the computer models in a manner that resembles real life using stereoscopic eyewear which tracks with the computer
Rapid-prototyping Tests new design concepts with models using plastic materials such as polyamide/epoxy resins
Collaborative design tools Use an internal Net or the Internet so that people can design together.

Source: After Schmitz, 2000.

personal computer is being used actively in the product concept stage – Internet for desk research, software for interpretation of statistical market research, computer-based literature searches and databases (Hegenbart, 1997). Newer developments are the use of detailed product models of present and past products to use as an information base to design new products (Jonsdottir *et al*., 1998).

What are specifications for product design? The product concept states clearly the needs and wants of the consumer or customers, but it does not provide specific guidance for design of the product in technical terms. It is often subjective and leaves room for different interpretations. Product concept engineering interprets the consumers' product characteristics into measurable terms, metrics, which can be tested in the product prototypes to see if the design is meeting the specification. An individual specification consists of a metric and a value, for example protein content between 20 and 30%; or thickness between 0.1 and 0.2 cm, or an ideal target value with an acceptable range, for example, strength of onion flavour, 7, range 6.5 to 7.5 on a linear flavour scale. Metrics and their values should be:

- critical to the consumer;
- consumer-acceptable ideal value and range of values;
- practical and capable of being achieved.

The product design specification is a set of individual specifications. Too many metrics should not be included, as this will limit the area in which the designer works and cause problems with too much testing. Only the metrics recognised as important by the consumer, or needed for the consumer such as safety, or for food regulations, are usually included, but sometimes there may be specifications dictated by the process or the distribution. Also it is important to choose metrics that are achievable, for example it may not be possible to choose vitamin C as a metric because heat processing conditions needed to ensure a

critical metric safety (microbiological) value, will destroy it. And metrics must be practical, for example there may be no measure for spicy hotness in a food so the acceptance of different levels in the new product have to be tested with consumers during design.

Choosing metrics and their values is simple if it is an incremental product or a copy of a competing product in the market. The metrics are already identified and the values can be chosen by competitive or company product benchmarking (Ulrich and Eppinger, 1995). With the radical innovation, there is not sufficient previous knowledge and there will be a need to continue the metric identification into later stages of design. As prototypes are developed and tested both technically and by the consumer, the metrics for the consumer-identified product characteristics are built. The design specification evolves to the product prototype specification at the end of the design process, so it does change, but care must be taken that critical metrics are neither dropped nor changed in value without consumer acceptance of the change. Factors sometimes causing changes in metrics are costs, availability or variability of raw materials and processes, new competing products, contradictions between product characteristics, difficulties in design. Nothing is black and white: usually various forms of grey have to be accepted.

Think break

1. Evaluate the two product concepts remaining after your work in the last Think Break, for marketing and production suitability. Make a checklist of all the important factors to consider in marketing and production and score the two product concepts.
2. Calculate a prediction of the possible sales volumes, prices and sales revenue for the two product concepts.
3. Do an evaluative comparison of the two product concepts and select the best product concept.
4. For the remaining product concept, write down the product benefits identified by the consumers and the other critical product characteristics you have so far identified. Suggest a metric for each product characteristic – this can be a physical, chemical, nutritional, sensory or microbiological metric.
5. What are the product characteristics for which you have not identified a metric? Can you create an empirical metric for them?
6. What are the raw material, processing and distribution requirements that need to be included in the product design specification?

3.1.4 Product feasibility and project plan

From the detailed knowledge, a more quantitative comparison can be made of the ideas for the new product. The consumer study gives in the product concept a

comprehensive description of the product characteristics wanted by the target consumers who are more clearly identified. The market research gives an indication of the probable sales of the product, the position of the product in the market, the possible prices, promotion and market channels. The technical study describes the possible products, processes and the probable costs and time for development and production. By a qualitative evaluation of the suitability of the product concepts and a quantitative estimation of the profits and costs ratio, and by predictions of the probabilities of successful development and launching, the most suitable product concepts for development can be selected.

The various activities needed for the project are firstly developed in the outcomes and then in the building of the product design specification. They are all brought together and integrated in the **operational plan** for directing and controlling the project. For the plan:

- list all the major activities;
- place them in a logical sequence, noting activities that run in sequence, in parallel, and those that need to be integrated (**project logic flow plan**);
- time each activity from start to finish (**project scheduling plan**);
- identify the money, resource needs, personnel, for each activity (**project resource plan**);
- identify activities that are critical for time and resources (**critical path network**).

Review the network so that it meets the required launch date and is within the resources designated for the project (**project operational plan**).

3.2 Product design and process development

The themes for Stage 2: product design and process development, are integration, creativity, systematic planning and monitoring. Food product development is process-intensive, the characteristics of the product are highly constrained by the processing. Therefore the process and the product are developed together. This tight integration of process development and product design, called concurrent or simultaneous engineering, is becoming more important because of the time and cost constraints on getting the product to the market (Fox, 1993; Stoy, 1996). Jonsdottir *et al*. (1998), reviewing concurrent engineering in seafood companies, defined the overall goal of concurrent engineering as quality, cost, schedule, product user requirements and reduction of the time the product takes to reach the market. They emphasised the information technology applications in product models, in particular the knowledge of the product's functional and structural characteristics, and the development of a system model that secures the integration and reuse of knowledge in the different stages of the product development process. The concurrent design also integrates with marketing and production (Hollingsworth, 1995) as shown in Fig. 3.7. Often in incremental development, the production

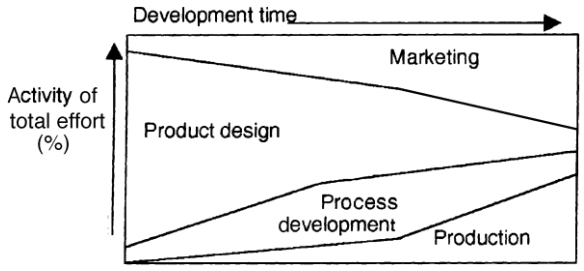


Fig. 3.7 Integration in product development.

plant is already in place, and the product has to be designed for that plant and the process can only be varied between narrow limits.

The company's identity or company's image is the sum of product design, communications design and environment design (Blaich and Blaich, 1993). Communication design directly supports the product in the marketplace with branding, packaging, advertising and promotion; therefore it needs to be closely integrated with the product design. Environment design is a concept that is not always considered, but it does influence the product and communications design, and the final acceptance of the new product. If a company wants to communicate the appropriate perception about its products, it must concern itself with the entire milieu surrounding the products, both inside and outside the company. If the company image diffused to the employees and the customers is quality, the new product is also seen as quality; if it is fresh and innovative, the product will be recognised as excitingly new. The company and distribution environments give the company and its new products an 'image' to the customers. Therefore product design needs to be integrated with communication and environment design throughout the design process.

3.2.1 Stages in product design and process development

The stages of the product design and process development are shown in Fig. 3.8; the activities are in the boxes, the outcomes in the ovals.

At the beginning of Stage 2, product design is the major part of the work, with process development considered in the design of the product. As the project progresses and the area for the product is more clearly defined, the study of the variables in the process becomes important so as to achieve the optimum product. The variables include both input and output variables.

- **Input variables:** raw materials (type, quality, quantity) and processing (types of processing, processing conditions).
- **Output variables:** product qualities and product yields.

The two main areas for research are formulation and processing; the first studying the type and quantities of raw materials and the second studying the

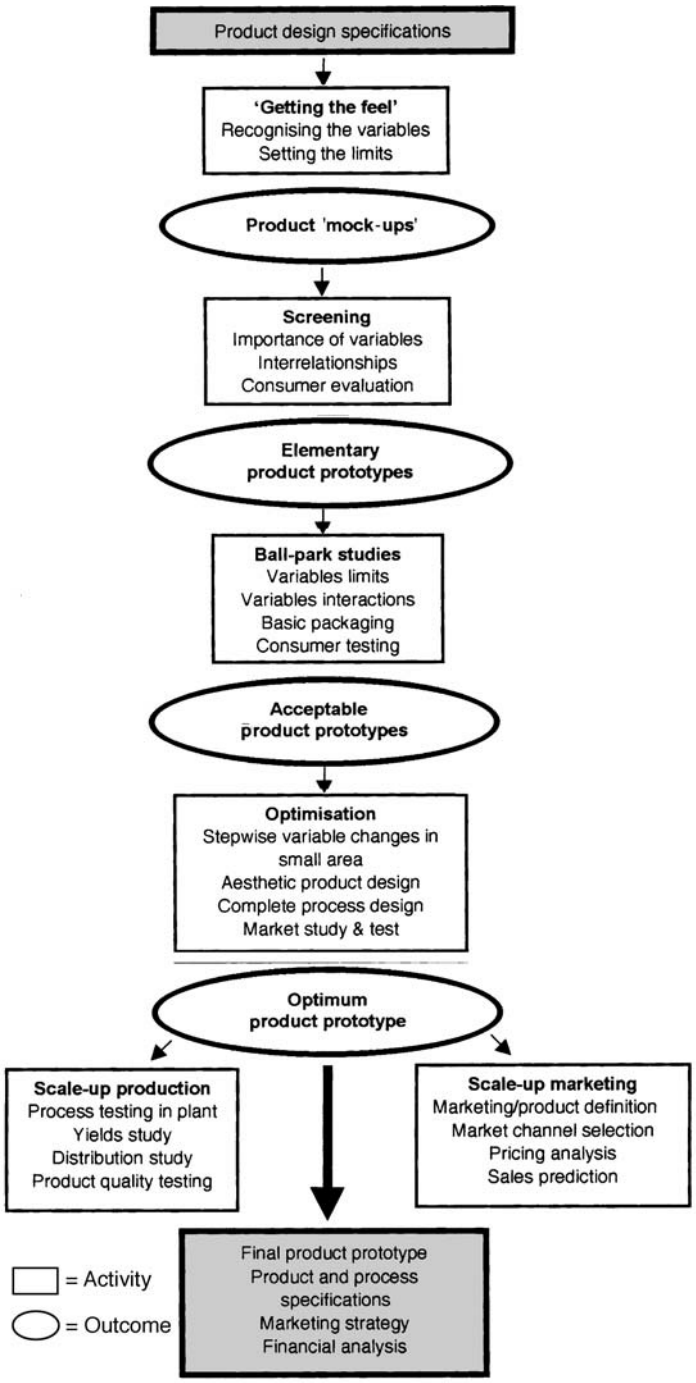


Fig. 3.8 Product design and process development: activities and outcomes.

effects of changing the processing conditions, but it is important that these are not studied separately as they are strongly interactive. The design is a continuous study of the relationships between the input variables and the product qualities, so that the final product is the optimum product under the conditions of the process. The prototype products are tested under the individual specifications set for the product design, so that product testing needs to be organised along with the product design and the processing experiments (Earle and Earle, 1999). Regular consumer testing of the product prototypes is necessary to confirm that the product has the characteristics identified in the product concept and not characteristics that are undesirable to the consumers.

Seldom does product design and process development occur in a straight line as in Fig. 3.8. There is back cycling because the prototype product is not completely acceptable to the consumer or the costs are not within the cost limits, or the chosen equipment cannot produce the product at the right yield or quality. It is important in each of these steps that there are technical, consumer and cost testings (Earle and Earle, 2000). The costs develop in stages from an identification of the parts of the company's cost system for this type of product and the limits for the various costs. Usually at the early stages, the raw material costs, their limits on the formulation, and the general costs of manufacturing are identified. The product, packaging and processing costs can be determined during the experimentation for the optimum product. After yield results during the production scale-up have been obtained and costs of marketing predicted, the total costs can be assessed.

3.2.2 Important factors in product design and process development

In food product design, there are some important points to consider:

Raw materials and ingredients

In many industries, there is increasing recognition of the place of suppliers in product development. In the past, the manufacturing company studied the effects of different raw materials and ingredients in the development of the product, and then produced specifications for the raw material/ingredient. Today, there is an increasing emphasis on working with suppliers in product development, and this is prevalent in the food industry (Hood *et al*., 1995). The ingredient supplier is introduced to the initial problem in the product design specifications and then cooperates in developing the solution. This is sometimes called the 'black box approach' and it is claimed to reduce the time for the project (Karlsson *et al*., 1998). Certainly the ingredient processor can be developing the process for the ingredient at the same time as the manufacturer is developing the consumer product. There needs to be a good relationship between the supplier and the manufacturer for this codevelopment to be successful. The food ingredient suppliers have actually gone further than this and developed the ingredient, the manufacturing process and the consumer product and handed this to the manufacturer. The reason for this may be the greater knowledge of product development in the food ingredient companies.

Quantitative techniques to integrate product and processing

In the past 20 years, there has been an increasing use of experimental designs and statistical analysis in food design and process development (Hu, 1999). There is software available that indicates suitable designs for the experimentation and analyses the results. Techniques such as linear programming have been used in animal feeds and petfood formulation for many years but have been slow to be used in human foods. Some of the problems in using quantitative techniques have been the variety of critical product characteristics, the poor definition of some characteristics and non-linear relationships between processing variables and product qualities. Food product design is complex but with increasing knowledge of the reactions in processing and new software, quantitative techniques will be increasingly the norm, but this will need increasing level of knowledge of the product designers and process developers. Hegenbart (1997) noted in product formulation, the use of spreadsheets to calculate formula costs, electronic information sources for ingredient supplier details, and company database of in-house ingredients; and in product testing the use of software for prediction of microbial growth in food and for sensory testing.

Aesthetic skills in product design

In the design of food, there has been extensive use of sensory science in developing a sensory product acceptable to the consumer. The industrial designers have not been greatly involved in the design of the appearance, colour, shape, but there has been interest in recent years (Pearlman, 1998; Capatti, 2000). Extended design is most immediately applicable to haute cuisine, but enters also into such items as extruded shapes and packaging. The package design is often by industrial designers and therefore relates to the artistic environment of the time. Airline meals (Kabat, 1998) and restaurant meals are influenced by aesthetic design and we have seen this with development of art nouveau, post-modern and other influences in meal presentation. Today, many food products are completely artificial, in that they are made from processed ingredients, and their design can be varied according to aesthetic environment. This is the area where aesthetic design can be a strong part of design – the question is how to encourage the industrial designer into food design or for the food designer to adopt some of the practices of industrial designers.

Values of the product characteristics

It is easy to spend a great deal of time designing a product characteristic that is of no importance to the consumer. Technical characteristics are often beloved by engineers in design but are of little consequence to the consumer. They may of course be an integral part of the product and therefore need some concentration in design. Value analysis or value engineering relates the cost of a product characteristic to its importance; and then selects the characteristics with the greatest value. There is a need to recognise the main aim of the product, for

example long life, and then to identify the characteristics of the product that relate to this, such as low water activity and controlled atmosphere, and then the cost of achieving them. There will be other characteristics, such as convenience, sweet fruity flavour, which also need to be fulfilled and other characteristics of less critical importance. The cost of these characteristics in the design can be determined to see if the cost is too high for the product characteristic, in other words above the value to the consumer. The highest valued characteristics are then the major part of the design.

Ergonomics

A neglected area in some food design, particularly in packaging, is ergonomics, the relationship of the physical product to the person (Ulrich and Eppinger, 1995). An example of poor ergonomics is an aerosol can for depositing a dairy cream on a cake or a dessert, that is mostly used by women and children, but cannot be held and used in one hand by them. Food is opened from a package, used in cooking, served and eaten; so design needs to take into consideration the physical aspects of the product and their relationships to humans using and eating it in all these steps.

Semi-production plant facilities

The stumbling block in technology transfer is the movement of the product from the laboratory to the full-scale plant. This is caused by various factors such as lack of processing knowledge of the food designer, the change in the processing conditions as equipment is scaled up, the difference in process control in the experimental and production plants, the transportation by pumps and lines in the production plant. Some products made and poured from a bucket or a jacketed pan will collapse when pumped around a factory. Many of these problems can be studied in a semi-production plant, without incurring excessive costs in materials and processing. When new products are based on incremental product changes, a semi-production plant can be used for a number of years and so the capital costs are paid back.

Internal and external capabilities

In the past, the aim was to have and build up the necessary expertise inside the company; then in the last ten years there was a popular movement to contract expertise from outside the company. On the one hand there is a need to have the activities of strategic importance inside the company so that the direction of the project is maintained. But on the other hand, there is a need to accept opportunities when they appear and if expertise is not available internally, to go out and buy it. Usually it is agreed that it is best to have an internal product development process championed, directed and understood by people inside the company, and to buy expertise from outside as needed. In other words have the company define the decisions, outcomes and activities in the PD Process, but contract out some of the tasks used in the activities.

Review and control of design process

The design process delivers the optimum product in the predicted time and costs – too idealistic? Yes, the design process is creative and working in the unknown, so it is difficult to be specific about product quality, time and costs. But there is a need to follow the product by regular testing – by the design group in the beginning and by consumers as the prototypes become more refined – to see that it is delivering the product. There also needs to be a time and resource plan which can be reviewed at different times in the design process by peer review to see if the project is effective and efficient (Fox, 1993). Problems will be encountered and there needs to be a recognised method of problem solving available to solve the problem quickly before the project collapses.

3.2.3 Conclusions to product design and process development

It is important that there is a clear end to this stage, and also the knowledge available to make the decision to go on or stop the project before the more expensive next two stages. This may not be the time to commercialise or the time to launch, so the project has to be shelved; or it has to be admitted that the product did not fulfil the expectations and the project must stop. Five important outcomes are:

- clearly defined final product prototype with consumer acceptance;
- product specifications including processing method, physical distribution;
- market strategy including distribution, promotion, pricing;
- prediction of investment needed and financial outcomes;
- probability of achieving project completion and financial outcomes.

Think break

1. For the product design specifications you prepared in the last Think break, identify the stages in designing the product prototypes and developing the process.
2. Create the basic product options by doodling on paper or computer or on the bench, evaluate them and select the most suitable basic product.
3. Identify the raw materials and processing variables related to the specified product qualities, and outline an experimental programme to identify the ranges of variables where the optimum product could lie.
4. Design an acceptable aesthetic product using the basic product, including appearance, shape, colour, sensory attributes and relating the product to the present culture of the target consumers.
5. Identify the packaging needs for the product, including protection and use, and also the needs for promotion of the product.
6. Combine all the knowledge you have so far created, and develop the final design for total product and package.

3.3 Product commercialisation

Stage 3: product commercialisation, is full scale-up of both production and marketing. These two developments need to be integrated throughout product commercialisation. Also design continues for the product, the production and the marketing, leading into the operational production and marketing. There is a need for integration, between the design and the operations. Product commercialisation ends with full integration of the product, production and marketplace. So the important factor in commercialisation is integration. Other factors to consider are the costs and the time. The costs really start to increase at this stage – maybe a plant has to be designed, built and commissioned; or fast-food outlets designed and built, or new distribution facilities built, all having a high capital cost. The risk of high financial losses increases as shown in Fig. 3.9.

There are four important stages in product commercialisation:

1. Setting up the commercialisation.
2. Design of marketing, production and distribution.
3. Testing of marketing, production and distribution.
4. Final integration of marketing, production and finance.

3.3.1 Setting up the commercialisation

The first activities in the product commercialisation are to agree on the aim, the resources and the final definition of the product and consumer relationship by developing an integrated project plan, and finalising the market and the product as shown in Fig. 3.10. All the people who are to be involved in the commercialisation need to be in the discussion, together with the product designers, so that there is technology integration between the design and the commercialisation. The

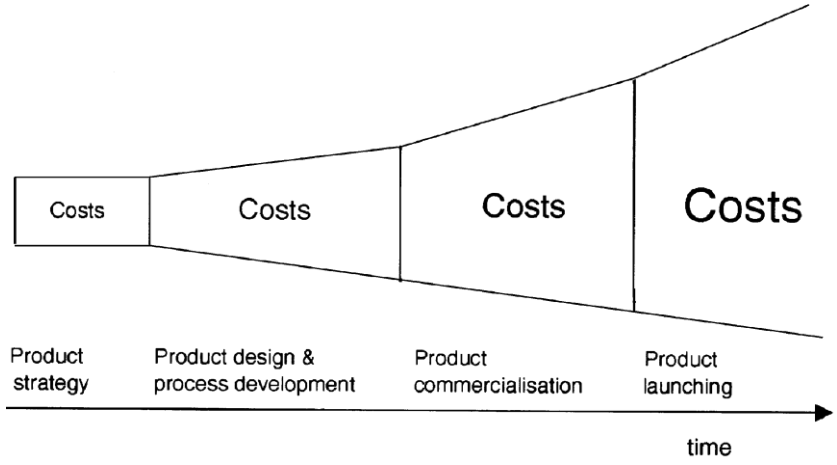


Fig. 3.9 Increasing costs in the product development process.

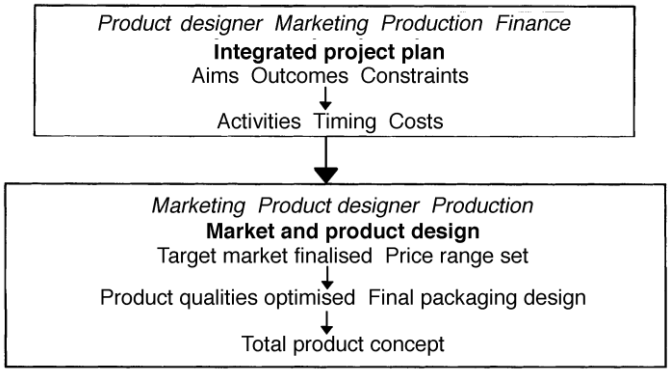


Fig. 3.10 Setting up product commercialisation.

business strategy is revisited at this stage to ensure that the product is still in harmony with the business. The aims and outcomes are becoming more specific because of the increasing knowledge created in the product design. It is very important that the aims, constraints and outcomes for the product commercialisation are considered in a combined discussion so that the different groups are not going in diverse directions and working towards different outcomes. For a drastic example, marketing and production may be aiming for different sales volumes, or marketing may be working to a price outcome not related to production's cost outcome. From the joint agreement on aims and outcomes comes joint identification of the necessary activities and then integration of the activities in the project plan. New constraints may have appeared because of competitive actions or changes in raw material availability, or changes in the finance for capital investment and some of them may have become critical. It is important to revisit and re-identify the critical constraints. Finally the timing and the costs for the various activities are identified so that the combined plan for commercialisation can be as efficient and effective as possible.

The other consideration in setting up the product commercialisation is to finalise the product and relate it to the target market. The total product concept needs to be built up from the market and product design (Earle and Earle, 2000), defining the core product, the total company product, the consumer's product concept and the society's product concept. There may be a need for some further product design to optimise the total product concept.

3.3.2 Commercial design

There are four types of design in product commercialisation – marketing, product qualities, physical distribution and production plant, as shown in Fig. 3.11. This is a time for many creative activities and they can career off into different directions. Nothing is worse than product qualities at variance with the marketing image of the product; for example product designers designing high-vitamin dog food and marketing building an image of a high-protein food. It is

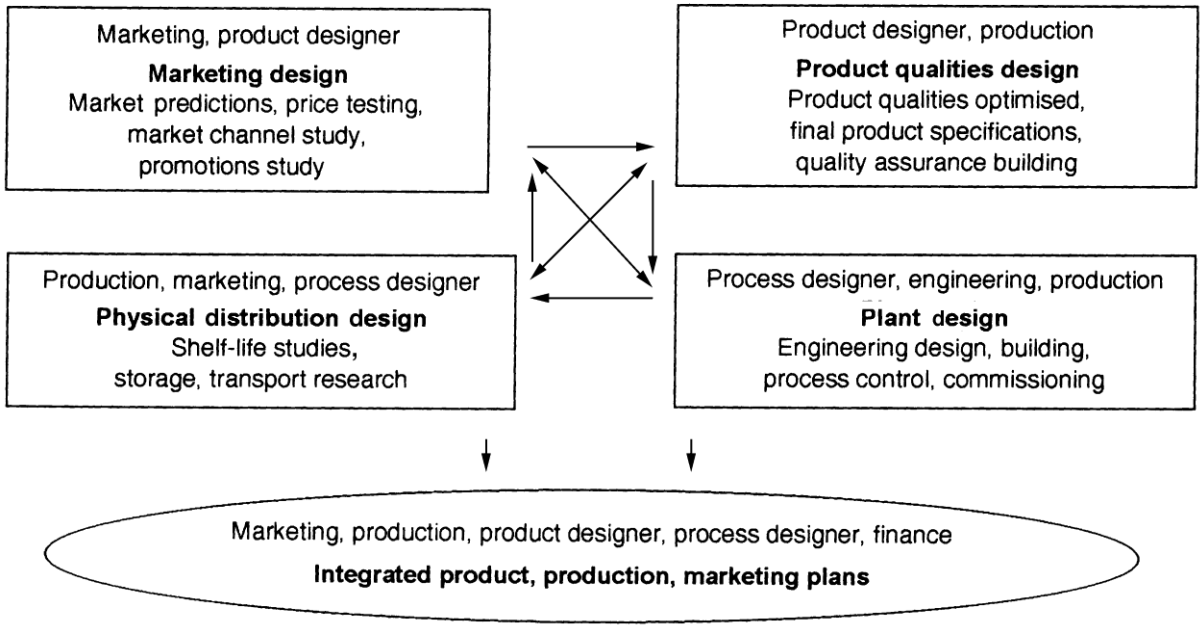


Fig. 3.11 Design in product commercialisation.

too late when the advertising designs come out and the designers say that that product is not what we designed! There needs to be close integration during the design and a final integration in the operational plans.

These are the general areas of activities but the choice of specific activities and techniques depends on (Earle and Earle, 2000):

- the type of product (incremental, innovation);
- the type of marketing (consumer, industrial, food service);
- the amount of learning needed by the company, the distributors, the consumers (high learning, low learning);
- scale of entry (local, national, international);
- the time (long, short) and timing (wide range, crucial).

For example, the time for the launch could be crucial because of competitive activity or the season, but the design has taken longer than expected, so the product commercialisation has to be rushed and the risk taken to drop some of the important activities. Companies often drop test marketing and business analysis when rushing to launch. But in all projects, time is expensive during commercialisation – an extra two weeks may make the costs shoot well over budget. So it needs to be well controlled.

Creating knowledge is another important aspect of the marketing and production design – as in all other designs. This is a major area of industrial research. For the incremental new product, the company has a great deal of past production and marketing knowledge and it is a case of fine-tuning the knowledge to include perhaps some production improvement and some new competitive marketing activities. But for the product innovation, it is a learning experience for company staff, distributors and consumers. The path of diffusion of the new product is identified, through all functional groups and top management in the company, the sales staff, the storage and transport operators, the retailers, the buyers, the users and the final consumers of the food. The learning experiences of all participants need to be incorporated in the activities in the final plan. Costs, revenues and profits are now assuming major importance and need to be followed carefully in the designs so the final financial plan is acceptable to the top management and the launch agreed.

3.3.3 Testing

The final product testing includes many aspects of the product:

- technical product qualities – core product qualities, packaged product qualities, agreement with regulations, services with the product;
- consumers' product concept – acceptance, competitive difference, uniqueness, aesthetic worth, brand attitude, product worth;
- marketing's product – product image, product position, promoted product, product price, retailers' product image;
- company's product – market share, sales revenue/profits, product effectiveness in business strategy, product problems, company fit;

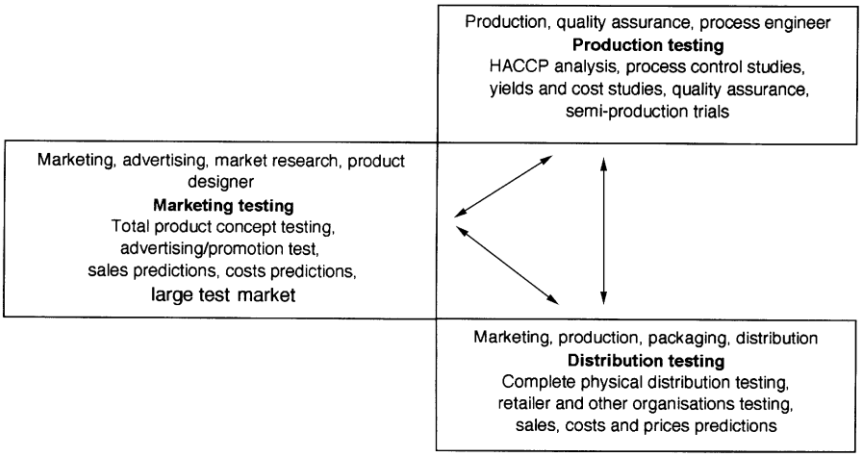


Fig. 3.12 Testing in product commercialisation.

- society's product – reliability, truthfulness of claims, protection from defects, value for money, social responsibility, environmental responsibility.

Combined with the testing of the product, there is production, distribution and marketing testing as shown in Fig. 3.12. Consumers test at least the total company product, with the packaging, advertising and public relations material; if time and cost allows the total product and the total marketing is studied in a test market. This can be an individual market or it can be the first phase in a roll-on marketing programme. Other important testing in the food industry is distribution testing which tests both the changes in product during transport and storage, and also the reactions of the retailers to the product. All food deteriorates with time – some in a few days, some in a year, and the effects of the temperatures, humidity, atmospheres and time during the transport and storage before sale has to be predicted. This is related to the label of the food with 'best by' dates.

An important aspect of testing today, which will increase with the trends into nutriceuticals, is ethical product testing. Ethical testing is related to a particular society; and the type and degree of testing depends on the ethics of the society. Basically people want to trust the food industry: firstly not to harm them and in fact to improve their health, and secondly not to use fraud and deceit when providing them with food. It is not ethical for the food industry to claim a lack of knowledge when being criticised by the society for unethical behaviour. When launching a new food product onto the market, the company must have extensive and detailed knowledge of the product's benefits and defects, of the raw materials and ingredients, and of the truth of the advertising claims. Always, the company knowledge must be more than the general knowledge in the society and in particular the consumers' knowledge, and the company must be willing to provide their knowledge. The company must not deceive any one about either

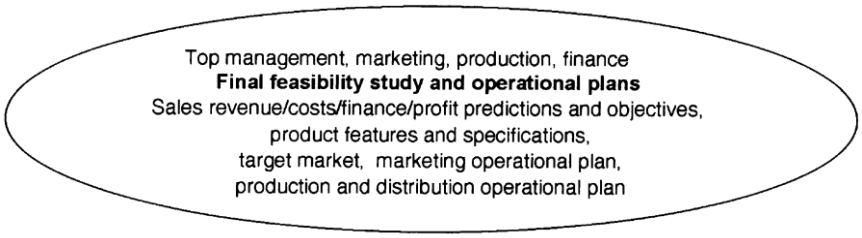


Fig. 3.13 Integration of product commercialisation.

the benefits or the defects or the problems associated with the product (Legge, 1999).

3.3.4 Final integration

The final step in product commercialisation is to bring together the knowledge from the design and the testing and to decide if the product is feasible; if it is, how it should be launched on the market. Integration is vital at this stage so that the launch can be efficient and effective (Andreasen and Hein, 1987). Obviously good decision making by top management is also vital, but management can only make decisions with the knowledge provided. The integrated knowledge is shown in Fig. 3.13.

The strategic orientation and the organisational capability are detailed at this stage. It is useful to develop a method of problem solving which can be introduced to everyone before the launch. Problems nearly always do occur in a launch and it is necessary to have a method of solving them to reduce both the chances of failure and the time taken for problem solving.

Think break

1. For your product designed in the last Think break, identify the aims, constraints and outcomes for the product commercialisation.
2. According to your expertise and knowledge, design the production, distribution or marketing. Ask some colleagues with different expertise to design the areas outside your knowledge.
3. Integrate the three design areas to give the total product/production/distribution/marketing of the product commercialisation.
4. Evaluate the integrated design for its effectiveness in achieving the project aims and for obeying the constraints on the project.

3.4 Product launch and evaluation

'Effective product launch is a key driver of top performance, and launch is often the single costliest step in new product development. Despite its importance,

costs and risks, product launch has been relatively under-researched in the product literature' (Di Benedetto, 1999). How true this is. Much of the research has emphasised the 'fuzzy' front-end activities and there is little on the critical back-end activities; in fact many PD Process models show seven or nine steps but only one for product launch!

There are three important parts of the launch – strategy, activities and demand outcomes (Guiltinan, 1999). The demand outcomes sought from the launch of the new product set the basis for strategy and the activities, and of course in the actual launch the strategy and the activities determine the sales outcome! This interrelationship between strategy, activities and demand outcomes is the major basis for planning the launch. The other important factor to consider is the evaluation and control of the launch; no matter how extensive the predictions for a launch, the unexpected always happens and there is a need for an evaluation and control plan.

3.4.1 Demand outcomes from the launch

The general demand outcomes include trial and repurchase, customer migration, innovation adoption and diffusion. The choice of demand outcome depends on the relationship between the consumer and the new product. Trial and repurchase, if the product is acceptable, is usually the buyer behaviour with incremental food products where the risk of purchase and eating is perceived as small. Buyers recognise the product as related to other products, the price is small and there is no great loss to the consumer unless there is a problem with food safety. Customer migration, the movement of competitors' customers to the new product, is the desired demand outcome when the product represents a significant improvement or change. The new product has a greater value for the consumer than the competitor's product and the ability to replace the existing product. Some of the situations for selecting particular demand outcomes are shown in Table 3.4.

Innovation adoption and diffusion are chosen where the product is new to the market and the consumer. This follows the traditional innovation curve with the

Table 3.4 Demand outcomes for product launch

Demand outcome	Product development project
Trial and repurchase	New product in existing market
	Line addition in existing market
	Emphasis on selective demand
Customer migration	Product improvement
	Emphasis on replacement demand
Innovation adoption and diffusion	New-to-the-world product
	Emphasis on primary demand, adoption and diffusion

Source: After Guiltinan, 1999.

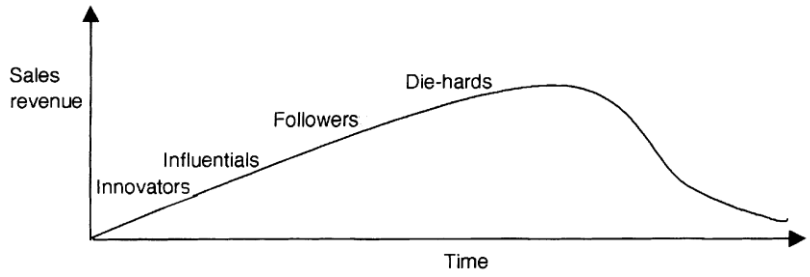


Fig. 3.14 The product diffusion cycle.

innovators, influentials, followers and die-hards as shown in Fig. 3.14. The diffusion curve can vary a great deal: the initial sales may be very slow and then there is a sharp rise, or there may be a fast initial rise and then a plateau. The shape of the curve is related to the product/consumer relationship but the launch tactics can affect it. The consumers may take some time to recognise and want the product so there is a slow uptake; or the product may fulfil an important need of the consumer, so they buy it immediately and sales increase rapidly. However, after the innovators have bought the product, the influentials and followers may take some time to buy and there is a plateau in the sales curve. Promotion and advertising can make consumers aware of the product more quickly than by word of mouth, and so they will buy earlier and the rate of sales growth will increase. Another marketing method to quicken the sales rate is to give consumers samples to taste in the supermarket; this gives them the opportunity to try the product at no cost, and if they accept the product they are encouraged to buy it. In launching, it is very important to understand the consumer/product reaction and how launch strategies and tactics affect it.

3.4.2 Launch strategies

The launch strategy can be described as the marketing, production and distribution decisions to introduce the product to the market and to start to generate sales. The launch strategies include the targeting strategy, the timing strategy and the product's innovation level. The perceived innovation level depends on the target market and also the competing products in the market. The target market can be a mass market or a niche market; the choice often governed by the size and resources of the company. New products may be aimed at a market segment, which is likely to be attracted to the new product, and then may be expanded to other market segments. Mass customisation in which the product is modified for specific groups of consumers is also another possibility. So there must be a strategy for reaching the target market segments.

Another launching strategy is to lead or to follow the competitors. This is an important timing strategy. With an innovation, the costs of being the pioneer can be high and if sales growth is slow then it takes some time to recover these costs.

But of course if there is a reasonably fast sales growth, then the product can win the major share of the market for a long time. With the incremental product, it is important to do this continuously with the succeeding products, so that the market share is either held or grows. To increase the market share, people of course make a product change so the new product must have their desired benefits and also needs marketing tactics to encourage them to make the change.

Hultink and Robben (1999) grouped the launch strategy decisions as:

- strategic product/market decisions – relative product innovativeness, targeting, introduction objectives and product newness;
- timing-related decisions – timing of market entry, speed to market.

These decisions have to fit into the company environment, its capabilities and resources, and the working environment of technology, market and competitors, as well as the surrounding societal environment. Successful launches were found to be related to perceived superior skills in marketing research, sales, distribution, promotion, R&D and engineering (Di Benedetto, 1999). Having cross-functional teams making key marketing and manufacturing decisions, and getting logistics involved in early planning, were strategic activities that were strongly related to successful launches.

3.4.3 Launch activities

There are two important decision areas for activities:

1. Marketing-mix decisions – relative distribution and promotion expenditures, relative breadth of product assortment, distribution channels used, marketing communications channels used, branding and pricing.
2. Production and distribution decisions – raw materials quality and quantity, production outputs, product quality, inventories, logistical times and quantities for delivery.

There are many activities in these two areas as shown in Table 3.5 and the problem is to choose the activities and integrate them. Very often there is emphasis on marketing tactics in the launch (Guiltinan, 1999) but the production and the logistic tactics can often make or break a launch. The launch strategy integrates the launch; and the launch tactics need to integrate the production, distribution and marketing activities so that they are focused on the same desired demand outcomes. Common pricing tactics are market skimming with a high price, and market penetration with a lower price. In choosing one of these, there needs to be consideration not only by marketing of the demand but also by production and distribution on the capability of producing the volumes and the costs of inventory in storage. Good launch management with control of activities and in particular of their timing and costs is the basis for a successful launch. The timing of the launch is all-important and sometimes activities have to be shortened to achieve this timing; this may cause problems for staff but it usually results in a successful launch unless everything falls apart!

Table 3.5 Activities in product launch and evaluation Marketing

organisation	Production organisation
Organising for the launch	
Finalise promotion	Design, build, commission plant
Media advertising contracted	Quality assurance finalised
In-store material prepared	Raw materials contracts
Sales presentation to staff	Physical distribution contracts
First introduction to retailers	Production finalised
Market channel/physical distribution organisation	
Product launch	
Launch targets finalised	
Complete selling to retailer	Produce the product
In-store material distributed	Distribute the product
Merchandising in supermarket	Check product quality in supermarket
Release advertising	Check product safety
Release product for sale	
Product launch evaluation	
Merchandising	Improving production efficiency
Advertising	Reducing product quality variation
Sales recording	Checking product in distribution
Buyers' surveys	Checking product in retailers
Competition study	Improving distribution efficiency
Marketing costing	Production and distribution costing
Financial analysis of costs, revenues	
Analysis of production, distribution, marketing	
Comparison of actual results with targets	
Adoption of product into the company	
New phase of advertising	Standardising production
New phase of in-store promotion	Total quality management in place
Pricing revamping	Raw material procurement revised
Sales recording	Output increased
Future costing	Costs reviewed
Sales analysis	Logistics optimised
Buyers' studies	Retailers' handling optimised
Future developments of product, production, marketing	
Financial analysis of investment, costs, revenues and profits	
Future returns on investment predicted	

Source: After Earle and Earle, 1999.

A very important aspect of launching is logistics; the aim is to have sufficient product on the shelves but not for too long. In the past, there was the practice of filling up with product the pipeline from the factory to the retailers' shelves, according to the predicted sales demand. This meant having a large inventory, which was costly, and in the case of introducing product lines did not allow for different rates of uptake of the individual products. A lean launch

strategy based on logistics and supply chain collaboration can greatly reduce the costs and the risks of the product launch (Bowersox *et al*., 1999). The lean launch strategy is based on response-based logistics, a flexible and responsive system with agile supply and manufacturing which can react quickly to real-time information from point-of-sale data transmitted via electronic data interchange (EDI) and Internet communications. The aim is to plan for lean inventory and to focus on in-stock position to support product successes, reduce stock of product failures and manage stock for niche markets. This gives better management of start-up costs, as sales will more rapidly balance costs and make a profit more quickly.

3.4.4 Evaluating and controlling the product launch

Evaluating and controlling the product launch is critical to success. The launch involves people and functions from all parts of the company, and the organisation of these people and their actions is complex. A well-planned organisational structure plans the activities, and can also quickly respond to problems caused by product quality, competitors' reactions and non-predicted consumer behaviour. Changes to activities or their timing can be made during the launch to counteract any problems arising.

Companies tend to build a 'launch' structure and use this for successive launches. For example in the food industry, it used to be a big TV campaign, backed by in-store promotions and simultaneous wide distribution in super-markets. With changes occurring in the food system, there is a need to be more adaptable so that the organisation system is permanent but the activities and techniques are selected for each project. In other words, the adaptability of the earlier stages of the PD Process is transferred to the launch. It is the most expensive stage and therefore requires the greatest knowledge from past experience. It also creates a great deal of knowledge, which should be captured for future launches.

Targets will have been set for the launch: short-term targets of sales volumes, sales revenue and market share, and long-term targets of a certain profit and return on investment and a time to recover the development and launch costs. Quantitative recording and analysis systems are set up to continuously analyse the sales and to improve the sales predictions. As the launch proceeds, the evaluation will become more definitive as more accurate data accumulate, and more realistic predictions of future cash flows can be made. The data necessary for the evaluation include production costs, prices, unit sales, sales revenues, marketing costs, company costs and finance costs. This is not just a recording system, it is also the basis for action during the launch.

One of the most difficult decisions is to change/not change the activities and the timing. If one reacts to every out-of-target result, then the whole system may get out of control; if a decision is delayed, the opportunity for success may be lost. It is important to follow trends and make decisions on these trends, not on spot data. The raw materials and direct processing costs are continuously

Table 3.6 Costs, finance and market monitoring during launch

Costs data		
Finances		*Analysis*
Raw material costs		Cost trends
Production costs		Costs breakdown
Distribution costs		Production efficiency
Advertising and promotion costs		Distribution efficiency
Product losses costs		Marketing efficiency
Wastes costs		Additional operational costs
Company costs		
Financial data		
Finances	*Revenues*	*Analysis*
Total costs of launching	Total sales revenues	Gross profit/loss
Cost of financing		Profit margin
Capital investment		Pay-back time project
Working capital		Pay-back time launch
Financial condition of the company		Return on investment
		Additional capital investment
		Additional working capital
Market data		
Sales, marketing		*Analysis*
Sales total volume		Market share overall
Prices, range, specials		Market share in individual retailers
Sales individual retailers		Per capita sales rate
Buyers' purchasing patterns		Purchase/repurchase pattern
Competitors' sales		Ratio of sales against competitive products
		Predicted future sales

checked to see if they are improving and are within or better than target. The distribution costs, delivery times and product losses during distribution (which also are an important cost) need to be recorded regularly. There needs to be systematic monitoring during the launch in costs, finance and market as shown in Table 3.6.

Following sales is only one of the outcomes that need to be monitored and controlled during the launch. It is necessary to check how the product is performing in distribution, storage and retail outlets – is the quality correct, is the product becoming unsafe, are there many product rejects in the system? The retailers' and the consumers' attitudes to the product are monitored – how has the retailer placed and promoted the product? How much are the consumers buying and rebuying? What do consumers like/dislike about the product? The answers to these questions are crucial to the future of the product and need to be found in retailer and consumer surveys during the launch. Some important factors to follow are summarised in Table 3.7.

Table 3.7 Monitoring of production, distribution and marketing

Production		**Distribution**
Raw material quality		Delivery times
Raw material availability		Delivery quantities
Process variations		Product losses
Yields		Quality of product on delivery
Waste – processing material, product, packaging		Quality of product on sale
		Inventory in company stores
Quality of product		Inventory in customers' stores
Equipment breakdowns		Breakdowns in delivery
Response of staff		
Marketing		
Retailers	*Consumers*	*Prices*
Reaction to delivery times	Consumer awareness	Price range
Product returns	Consumer reaction	Specials prices
Shelf space	Consumer buying	Price/demand relationship
Promotion	initial	
Prices	re-buy	
Orders	Consumer segments	
	Relationship to other products	
Advertising and promotion		
Coverage	Effectiveness	Communication
Impact	Precision	Focus
Reinforcement	Relevance	Emphasis
Retention	Acceptance	

Think break

Using the knowledge from your product commercialisation in the last Think break:

1. Outline the demand outcomes wanted from the launch of your product.
2. Develop for your product launching
   (a) relative product innovation level strategy,
   (b) targeting strategy,
   (c) timing strategy.
3. Outline the critical monitoring points in the launch and describe the information you would collect at these points.
4. Discuss how you would analyse this information and use it to make decisions on the launch

3.5 Service in product development

The previous sections discussed new product development in general, but sometimes new services have to be developed as well as the physical product. In

these cases, a product and a related service are developed together. In developing new industrial products, the new product benefits and the service to the customer need to be developed in tandem to give the optimum integrated product. In food service, the service component is of major importance; for example in a high-class restaurant, the service of individual attention, and in a take-away chain, the service of fast convenience, is all-important. The basic four-stage PD Process is the same for new product and service development, but the activities and the organisation can be different. An integrated process including product and service needs to be used where product and service are developed together.

3.5.1 Services

Services are intangible as compared with tangible products. They are intangible experiences that are produced and delivered simultaneously. An important feature of the service is that it is adaptable and can change with different customers; this is just about the opposite of the tangible product, which stays the same for all customers. Service customers want individualised experiences that yield strategic benefits for them as individuals. The customer and the company employee are parts of the service; it is their interaction that is the service. Therefore service quality is highly variable, but it is very important, as the customer reaction is immediate (Terrell and Middlebrooks, 1996).

The customer's concept of the service includes the company's service system as well as the company skills and knowledge. From the customers' point of view, important features of a service are (Walton, 1992):

- treatment of the customer;
- speed and convenience of service;
- price of the service;
- variety of services;
- quality of the tangibles that accompany the service;
- unique skills that constitute the service offering.

From the company's point of view, a service has three parts: the service itself, the augmented service (service firm's reputation, quality of the interaction with the firm's system and staff) and the marketing support (Storey and Easingwood, 1998). The total service is shown in Fig. 3.15. In developing a new service, the three layers of the product have to be integrated so that the total optimum product is achieved.

3.5.2 New service development

With growth in the service industries in the 1980s and 1990s and the increasing need for new 'products', there grew an interest in the method of developing new services. In the 1980s, new service development started with the basic model of Booz, Allen and Hamilton (1982). A typical process was to develop a business

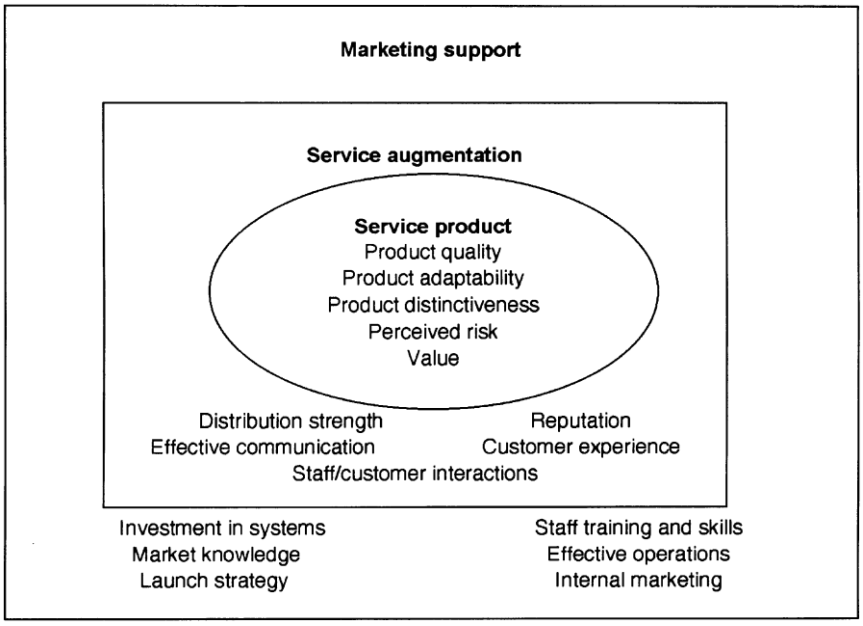


Fig. 3.15 Augmented service product (Source: After Storey and Easingwood, 1998).

strategy, develop a new service strategy, idea generation, concept development and evaluation, business analysis, service development and evaluation, market testing and commercialisation (Bowers, 1989). As service development grew, specific service development processes were produced (Johne and Storey, 1998). Scheuing and Johnson in 1989 proposed four stages – direction, design, testing and introduction, and identified a 15-step sequence of activities.

- Direction (or service strategy): formulation of new service objectives and strategy, idea generation, idea screening.
- Design: concept development, concept testing, business analysis, project authorisation, service design and testing, process and system design and testing, marketing programme design and testing, personnel training.
- Testing: service testing and pilot run, test marketing.
- Introduction: full-scale launch, post-launch review.

This model emphasises the intricate interplay between the design and testing functions during the design of a new service. The involvement of the operations personnel and the users is an important feature in the design stage. Customer participation is an essential part of new service development. Employee participation is also necessary, as the front-line employees are delivering the service. They are psychologically and physically close to the customer, and can identify customer needs and problems. If employees and customers are involved in the development, they will also behave knowledgeably and willingly in the delivery of the service. Therefore the design process in service development

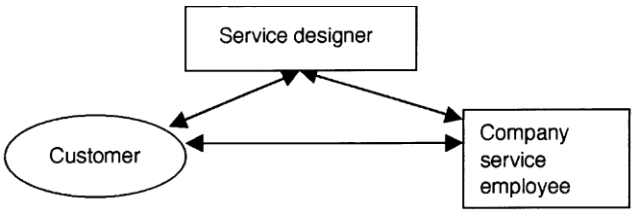


Fig. 3.16 The design triangle in service development.

needs to include the designer, the customer and the employee as shown in Fig. 3.16. The designer, customer and the service employee are usually not individuals, but three separate groups – the customer's group, the development group in the company and the company marketing organisation.

The question is how well can new service development fit into a service development process? Edvardsson *et al*. (1995) concluded from their studies that innovation of new services is an extremely complex process when it comes to planning and control. Their four stages were idea phase, project formation phase, design phase and implementation phase; they suggested it was not a sequential process but an interacting process. The stages overlapped and could not be clearly identified. Edgett (1994) found that the launch plan must be part of the development process. It needs to be well planned and coordinated, with communication materials and marketing targeted correctly and backed with sufficient resources. New service development can be a planned process following the four stages of the PD Process, but there is significant iteration in and between stages because the strong involvement of customers and service employees does not allow a rigid sequential structure. Two important stages are the service strategy and the service design.

Service strategy is the direction for development based on the business strategy. Some of the service innovation strategies include positioning, process, new service, employee/customer relationship and communication (Stinson, 1996). Examples in the food industry are:

- commodity meat suppliers repositioning to ingredient meat suppliers with products tailored to high class hotels and restaurants;
- restaurant changing from table service to self-serve;
- frozen food company introducing a new home delivery of frozen meals, nutritionally balanced for different age groups;
- starch ingredient supplier developing a buyer contact group with recognised product development skills;
- soy products company opening an on-line data base so that their clients can formulate new products.

Service design includes service concept, service system, service process (Edvardsson and Olsson, 1996). The service concept is a description of the customer's needs and how they are satisfied in the form and the content of the

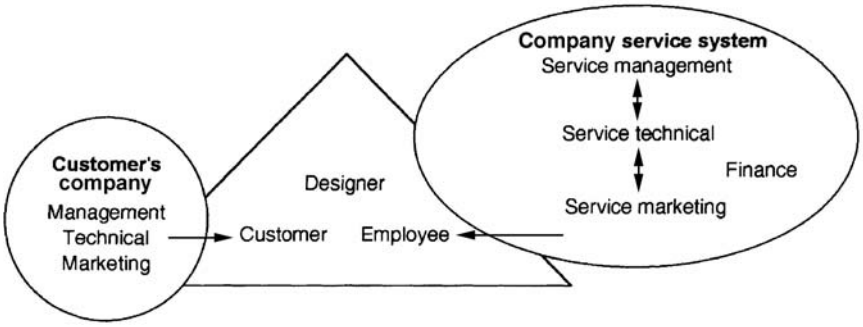


Fig. 3.17 Company service system and customer group within the design triangle.

service. As in product development, the customers have needs, wants and expectations. Expectation is critical in service – as can be seen from the attitude of any diner in an expensive restaurant, or a child in McDonald's. Expectation is based on the customers' needs and wants but it is also influenced by the company's image or reputation on the market, the customers' previous experience of the service company, the service company's marketing. The customer perceptions of the company and the service, especially as compared with competitors, have to be taken into consideration in the design of the service.

The service system in the company is mainly the people in the company, not just the front-line staff but the whole chain of customer relations in the company. The customer is relating to the technical resources and administrative routines and procedures in the company, as well as the marketing personnel. There is also a relation with finance as they are setting limits on prices, financial contract and investment. The whole company system is a part of the service design as shown in Fig. 3.17. The service system includes the resources available for the service development and operation. The finance section is involved not only in allowing the resources but also in setting the financial arrangements with the customers. Marketing has a key role in building up the part of the customer in the service, in particular to inform, educate and give them the skills to take part in the service. The technical people are involved in designing the hardware and software supporting the service.

The service and the customer outcome are generated in the service process. The customer is present in the process and affects the result (Edvardsson and Olsson, 1996). The nature of customer contact is a factor in the design – is it mail, telephone, face-to-face; long-term or short-term relationship; casual or a contract? There are individualised customer experiences in which the company may wish to be involved or keep at a distance. The behaviour of the customer must be taken into account as the service process is built up. In designing the service process, a framework of activities is built up from the customer introduction to the service to the customer outcome of the service. The service process consists of a clear description of the various activities needed to generate

the service – service company staff, the customers, the physical/technical environment and the organisational structure. The service process depends on the resources – people, knowledge, skills – in the company and how they are organised. The customers also have knowledge, skills and procedures that need to be taken into account in the design of the actual process for delivering the service. The service process designed is a framework, but it will vary with every customer; every customer makes it an individual customer process.

In developing from the service concept to the new service, there is constant interaction between the service concept, the system and the process; and testing of various combinations with the customers and the employees. This gradually expands with increasing numbers of customers into pilot testing, test marketing and the final launch.

3.5.3 Industrial food products and services

There are two different groups in industrial business-to-business relationships – the industrial buyer (food processor or manufacturer) who employs raw materials and food ingredients in manufacturing a food product, and the industrial supplier of raw materials or ingredients (farmers, primary processors, ingredients processors). There is a great variety of buyers and suppliers, and also a wide variety of products. The product development varies from a branded coffee for one-person coffee bars, which is similar to consumer product development, to the highly specific ingredient for one large multinational food manufacturer. But there are some general factors to consider in developing new industrial products (Schaffner *et al*., 1998).

The types of products

These could be raw materials from farm and sea, specialised commodities, bulk industrial products, partially processed materials, processed products, processed speciality products.

The industrial food-product characteristics

The industrial product can be divided into the tangible product, the uses of the product and the services that are marketed with the product. Some important features of industrial food products are shown in Fig. 3.18.

There is a tangible product that has specific composition, microbiological levels, physical properties and sensory properties, and there is the customer's product which includes the qualities directly related to the buyer – their uses and also the quality of the derived product made from the raw materials, usually the consumer product. In the customer's product there are also special features, quality and specifications, packaging and branding. Services included implicitly or explicitly with the industrial product can be reliability, safety, availability and replacement, technical information and help, delivery and credit. The service product can also include some or all of the features in the service augmentation and marketing support shown in Fig. 3.15. Products are not just a physical entity

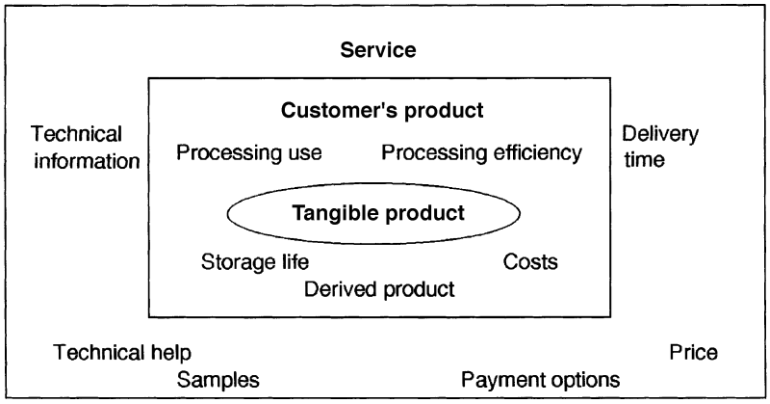


Fig. 3.18 The industrial food product (Source: From Schaffner, Schroder and Earle, *Food Marketing: An International Perspective*, © 1998, by permission of the McGraw-Hill Companies).

but an array of economic, technical and personal relationships between buyer and seller.

Industrial buyers

Industrial buyers can be grouped together as market segments. The buying company can be buying directly for their own use or for reselling to the users. The users can be segmented as shown in Table 3.8.

Think break

A large oils and fats ingredient company plans to develop a new pastry margarine product and is trying to identify a target market and new products. Possible target markets are pie manufacturers, frozen pastry manufacturers, croissant manufacturers, biscuit manufacturers, cake shops, small retail bakers, supermarket bakeries and hotel patisseries.

1. Choose some suitable segmentation factors from Table 3.8 and assign the target markets into the segments. Select what you think are the two most suitable segments for a new pastry margarine product.
2. Identify possible new products, both incremental and innovations, for each segment.
3. Evaluate these new products and select the two most promising ideas.
4. Identify the most important 'customers' to include in the design process for these two new product ideas.
5. What tangible product qualities would they need?
6. What services would they need?
7. Sketch the complete product concepts for the two products.

Table 3.8 Methods for segmenting industrial buyers

Stage in the food chain: primary processor, secondary processor, caterer, retailer.
Type of processing: for example baking, freezing, dry mixing, sterilisation.
End consumer products: for example snack foods, takeaways, breakfast foods.
Size: number of employees, amount of capital, turnover per year, production volume.
Technical knowledge and skills: high technology, average technology, craft.
Usage rate: large, medium, low; regular, variable.
Type of purchaser: new, old, repeat, contract, casual.
Organisational structure: private or multinational company, farmers' cooperative.

The needs and wants of the buyers

All buyers are interested in firstly the ease of using the ingredient in the process and secondly the cost and quality of the final products. Although the buying action is logically based on these needs, there are still some psychological reasons for buying. Basic needs and wants of the industrial buyer are shown in Table 3.9. Actual needs and wants do vary with the different people in the buyer's company. For example:

- Production personnel – delivery time, reliability in supply, constant quality, ease in processing.
- Product development personnel – ease and shorter time for development, final product qualities.
- Quality assurance personnel – raw material specifications, ISO standards, narrow range of quality variation.
- Purchasing personnel – reliability of supply, price, size of delivery, regular deliveries.

In looking at these needs, one can see that there is an emphasis on service as well as the product, and this reinforces the need to develop the service with the

Table 3.9 Needs and wants of the industrial buyer

Availability	**Use**
Ease of delivery	Convenience in processing
Ease of storage	Uniform, stable, processing
Ease of ordering	Technical simplicity in processing
Reduced risks	**Costs**
Safety	Costs, discounts
Financial losses	Value
Product failure	Payment method
Staff failure	Payment time
Equipment failure	
Knowledge	**Outcome**
Technical information	Production of uniform, acceptable products
Formulations	Satisfactory sales and profits
New and improved consumer products	Competitive advantage
Help in processing	Few equipment problems
Information on derived products	Efficient staff use
Marketing help with derived product	

product. In developing industrial products, there is a need to identify the important people in the buying company as regards this type of ingredient and to find from them their needs and wants in the new ingredient, and decide how their needs and wants relate to the buying company's critical needs. In other words, the product development team in the supplier's company needs to understand the buying company's overall needs in product and services, and also the needs and wants of some individuals.

The PD Process

The PD Process is therefore a combination of product and service development. In the past, these have been done in sequence, completing the product development process, and then starting the service development. This leads to an increased time for development and also sometimes to a lack of harmony between the product and the service. In Fig. 3.19, there is an attempt to combine the product and service development processes to give an integrated product and service. The integrated product/service development process is particularly useful when new products are being introduced with a new service process and a new service system. The service system may already be in place and a new product and a new service process will be developed. This still means integration of the two development systems.

De Brentani (1995) has suggested three successful scenarios for industrial service development:

- Customised expert service: expert capabilities and resources providing customers with customised and high-quality service.
- Planned pioneering venture: pioneering new service ventures aimed at attractive, high-volume markets.
- Improved service experience: enhanced speed, good service quality and reliability.

Think break

The sales office of a large flour miller has just received a bread-baking mix from the production department. Recently there was a marked increase in the number of small hot-bread shops and the salespeople think that these small bakers might be a good market for this product. A salesperson knows a small baker and takes a bag of the mix to him. The baker promises to try it and in a day or two the salesperson has a telephone call from the baker to say that the product was a failure – there were difficulties in processing and the final loaf was small and hard.

1. How might the salesperson have handled this better?
2. How did the company go wrong in its industrial product development process?
3. Suggest a product/service integrated product development process for this company to ensure more successful new industrial products.

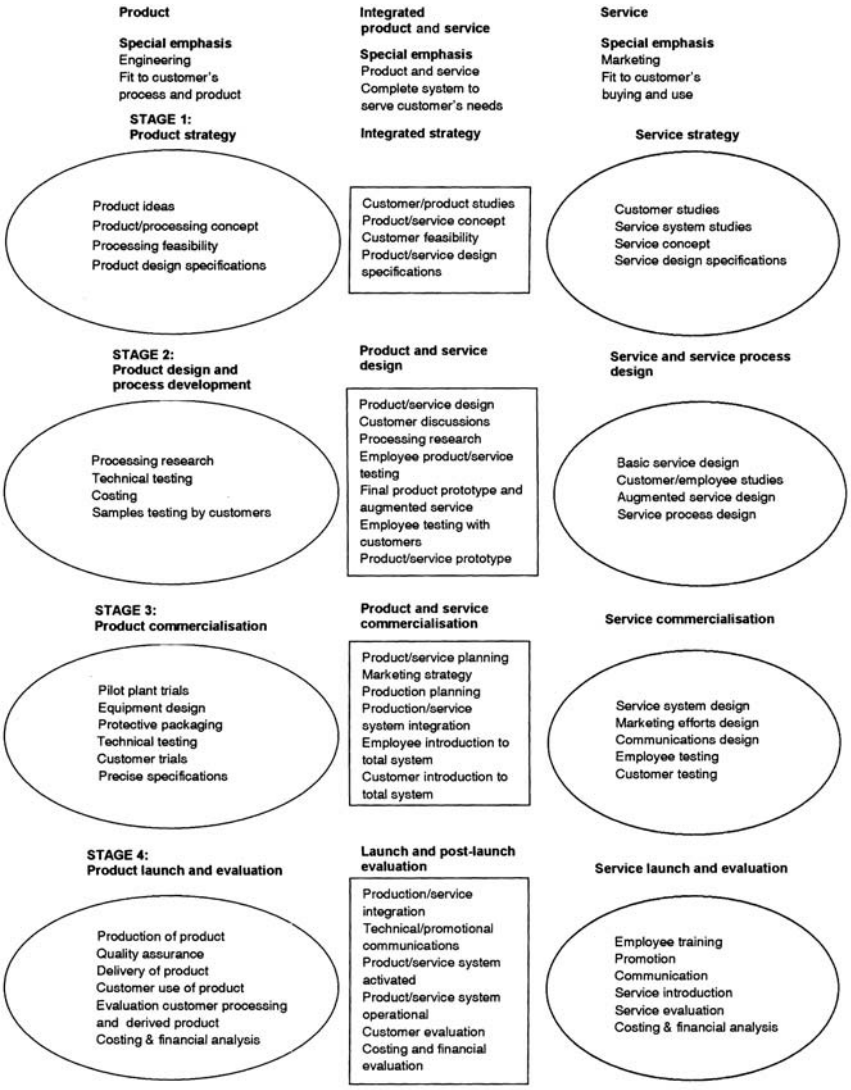


Fig. 3.19 The product/service development process for industrial products.

3.5.4 Food service development

In food service, there are three participants – the food manufacturer/food processor, the food service organisation and the customers – and two product development processes – the food manufacture and the food service. The two product development processes may be working in parallel or in sequence. The supplier's product development usually follows the standard sequence of the industrial product development process; in food service, product development is a major part of menu planning. The food service product involves the dishes

offered and the service delivery of those dishes in the dining/eating environment. Both the food service operator and the customer want service as well as the product. Therefore food service development is a complex interweaving of product and service, through two development projects. There may even be another commercial customer between the food service and the customer; for example, in flight catering there are food manufacturers, flight caterers, the airlines and then the passengers. In developing new in-flight meals, the airlines regard new meals as service development, the catering services as service and product development, the food manufacturers as product development with some service development. Some new developments for in-flight meals are shown in Box 3.2 to illustrate the variety of development taking place.

Food service development is usually based on menu planning, which has five major aims: creative, nutritional, marketing, economic and logistical (Roberts, 1997). This food design is strongly aesthetic, but there is also a price direction and a serving need. Today, there is an increasing inclusion of nutrition into the design aims. The basis for the new development is the design of dishes, which are combined to give the new menu or in the case of institutions a whole meal structure (Ngarmsak, 1983; Roberts, 1997). In some instances such as takeaways, there is only one dish to be designed, although this has to be related to the overall takeaway product mix. Usually there is an existing menu, which can be improved by adding new dishes, or which can be used as part of a new menu. Development of new dishes is the basis for the menu change as shown in Fig. 3.20.

The supplier can give the new ingredient to the menu planner and let them take this through their PD Process of ideas, idea screening, recipe formulation, trial dishes, trial dish evaluation, standard recipe, menu design, menu trials,

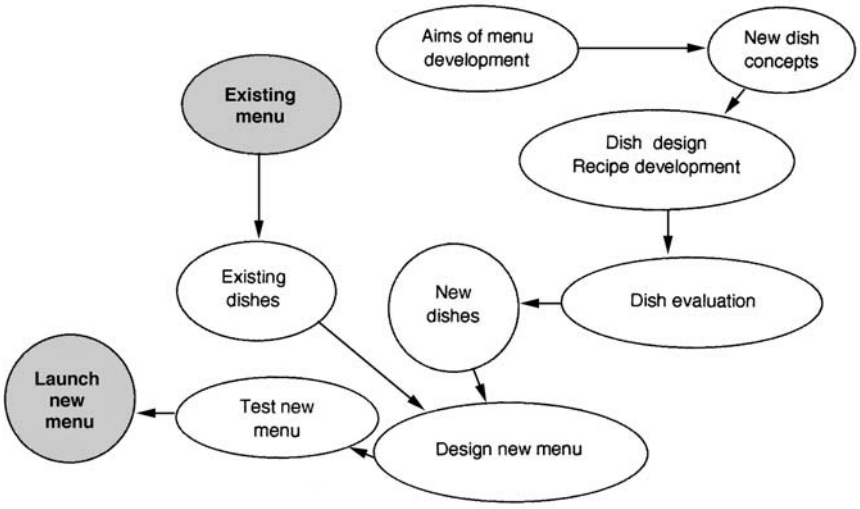


Fig. 3.20 Menu planning for new menu (Source: After Roberts, 1997).

Box 3.2 Developing new products and services for in-flight catering

Product: Meal components

Delta Daily Foods are a medium-sized food manufacturing company based in the Netherlands producing food items for both flight catering and supermarkets. They have developed a system for freezing individual vegetable and meat products, moulded in specific shapes that can be assembled by hand and even robot machinery into main dishes for in-flight trays.

Service: British Airways 'well-being in the air' concept

Based on extensive research into food trends, nutrition, macrobiotic diets and the oriental art of well-being, this takes the form of an advice pack for passengers on how to prepare for air travel, what to eat and do on board, and ideas concerning exercises and relaxation. Meals are designed to blend with this concept.

Process: Materials-handling system

SAS Service Partners and British Airways central production unit at London's Heathrow airport applied technology developed in the motor industry to flight catering equipment handling. This entails moving food trolleys on hooks suspended from a moving beltway from the unloading dock, through the wash-up area and into storage.

Software: Electronic reproduction of meals

Abela/Gate Gourmet developed a software package that produces electronic reproduction of images for catering. This system stores detailed recipes and dish specifications, along with full-colour digital menu pictures originally captured on video camera. The coded, kitchen-proof, keyboard enables chefs to access any menu or dish and enter the number of meals required. The system then computes the amount of each ingredient required and provides full specification and digital image on a colour printer.

Source: After Jones, 1995.

menu launch, or they can work with the menu planner in developing the meal ingredient or meal part. This combined product development occurs in stages as shown in Fig. 3.21. These are the overall activities in the two interacting PD Processes, but of course there are variations caused by the different situations.

The menu planner in the PD Process can be the product development manager for a large chain, the owner of a restaurant or the senior chef managing

Supplier PD Process	Interface	Food service PD Process
Stage 1: Product and menu strategy		
Exploratory market research	*Needs of chefs/menu planners*	
Product ideas		Menu ideas
Preliminary ideas		
Product concepts		Ideas for dishes
	Product concept agreement	
Development of design specifications		
Stage 2: Product and dish development		
Product design		Dish ideas screening
Samples for testing		Recipes formulation
	Product characteristics agreement	
Product improvement		
Process development		Trial dishes
Costing		Trial dishes evaluation
		Costing
	Development agreement	
Stage 3: Product commercialisation and menu planning		
Product technical testing		Final standard recipe
Production trials		Menu design
Quality assurance		Menu consumer trials
Product specification		Menu improvement
Production and delivery planning	*Product specifications agreement*	Final menu planning
		Risk analysis
Costing and pricing		Costing and pricing
	Contract negotiations	
Stage 4: Product and menu launching		
Production		Storage method
Quality assurance		Cooking methods
Delivery		Serving methods
Production analysis		Menu introduction
Customers' reactions	*Product quantities agreement*	Consumers' reactions
Evaluation and costing		Evaluation and costing
	Contract concluded	

Fig. 3.21 Developing meal components and menus.

a hotel, restaurant or institutional kitchen. The wants and the abilities of the menu planner are important in planning the activities in the PD Process. Two other important groups are the consumers and the providers of information to the menu planners, such as other suppliers and their professional associates. The management of the food service company strongly influence the overall product and service, particularly as regards price and choice of supplier. There are two important relationships: supplier/food service and food service/consumer. In designing an ingredient, the supplier has to bring these two relationships together, preferably by conducting research with both consumers and food service outlets; or if this is not possible, by obtaining consumer information from the food service company. Product development activities in food service are also influenced by:

- menus – menu analysis, menu planning, menu changes (type, timing – periodical, continuous);
- food service company – outlet type, meal periods, size, development capability, skills and knowledge, needs, wants;
- supplier company – type, size, development capability.

The products from the supplier to the food service include basic ingredients, meal components, partially prepared–not cooked meals, and pre-cooked, complete meals. The benefits of new products that the menu planner/chef usually identifies are in the areas of ease of use, safety, prestige of product and reliability. Two fundamental needs are value and risk; increased value of the dish or decreased costs is wanted, but risks of failure and indeed food poisoning are always present.

The benefits identified by chefs at the product concept and product development stage for two meat products in the hotel and restaurant market in Melbourne, Australia, are shown in Table 3.10 (Roberts, 1997). The study compared a meat product with little processing (thin beef slices) with a meat product with moderate processing (fricadelle, an alternative to the beefburger). The sliced beef was a basic ingredient, and the fricadelle was already prepared and only needed grilling. The chefs were looking for ingredients that would save time but also could be used for different dishes. In this situation with chefs selecting the products, beef slices were favoured over the fricadelle. It was interesting to see that there was a change in attitude between the written product concept and the actual prototype. The quality of the beef slices increased, but that of the fricadelle went down.

The risks were also studied in these two products. The important risks identified by the chefs were increased staff costs, food safety risk, too high use of one piece of equipment, increased storage capacity required, high financial losses, chef skills vulnerability, poor peer recognition and failure of the product in the marketplace.

Table 3.10 Product benefits identified by menu planners for two meat products

Product benefits	Percentage of respondents scoring highly			
	Tender beef in thin slices		Fricadelle	
	Product concept	Product prototype	Product concept	Product prototype
Save time	94	81	61	70
Versatility	68	68	42	40
Value for money	65	58	55	27
Quality	26	55	23	23
Need	55	32	39	17

Source: From Roberts, 1997.

The stages in the adoption process used by menu planners are product awareness and interest, product concept, prototype trial and product adoption (including post-purchase evaluation). For awareness and interest, direct word-of-mouth communication between developer and adopter is important. Concept evaluation is a vital stage in the new product development process for satisfactory development of product specifications. The decision to try the new product is often based on cost, quality, need to save time and risk involved. The quality is often related to the consumers' needs as well as the chef's needs, so consumer testing is necessary. It may be organised by the supplier so that the food service has evidence on how the product is accepted by the consumers, but of course the chefs will also trial it themselves, probably in a blackboard menu. Product adoption by the food service company may not be systematic, but a case of trying it in the kitchen and giving opinions on the dish's acceptability and the cooking benefits and problems.

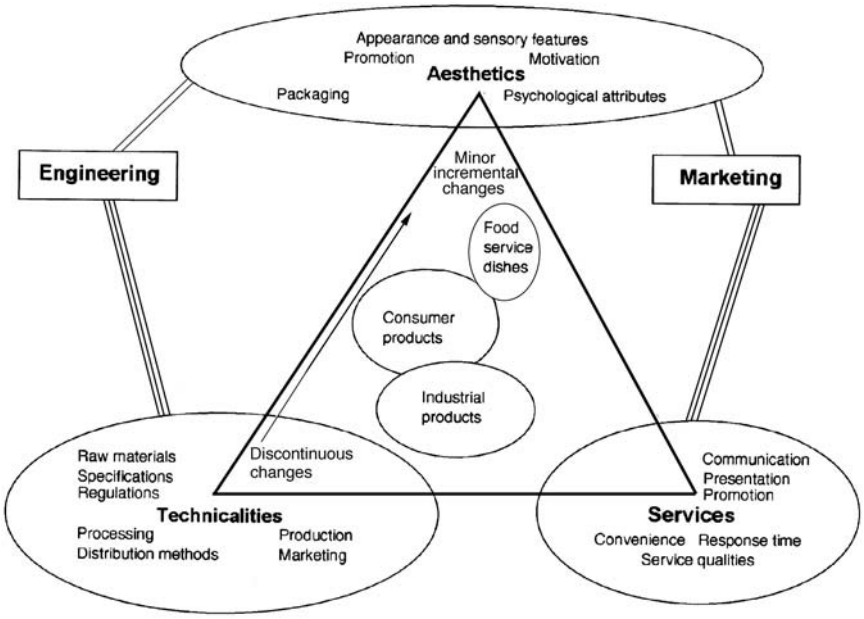
3.6 Where is the product development process going?

The project development process has settled into a well-proven stage pattern with critical reviews at each stage (the Critical PD Process). These reviews give opportunities for careful examination of progress, which if passed leads to the next stage and if not to abandonment or recycling as appropriate. Generally a four-stage PD Process is clear and sufficient, though in some projects substages may be necessary, especially for major innovations taking time for development. The importance of the activities and their sequence within the stages are determined by the level of innovation, the resources available to the company, the timing of the project, the company's risk level, and the knowledge and skills in the company.

One important factor is the degree of novelty, ranging from product improvement to a major product innovation. There can be a standard PD Process with a reduced number of activities for each project where there is:

- more or less continuous modification of an existing product line with fairly minor changes to produce variations on products;
- processes, equipment and markets are substantially unaltered; and
- no major shift in structure and organisation of the company's product development.

If the company has a data recording and storage system for product development, there may be sufficient knowledge of consumers, markets, products and production to reduce the research in the first stage, and also in the product commercialisation. Even the product launch can be a standard procedure. For these incremental changes in products, there can be a standard PD Process which is steadily improved after the analysis and evaluation at the end of each project. The efficiency and the effectiveness of the product development process can be improved over time.



Key:
Strength of relationships: — weak; ═ moderate; strong

Fig. 3.22 Indicative influences affecting activities choice in the PD Process.

For major discontinuous changes, there is a need for more exploratory activities in the first stage of the PD Process, and also because of the large costs involved there will be more project and business analysis throughout the project. The decisions are major because of the resources needed, and therefore a great deal of knowledge is required which usually has to be created in the project. A consistent, logical process is needed, but it cannot be highly structured because of the unknown nature of the project. The process is usually more exploratory and less customer-driven than the typical incremental product development process. It concentrates in the first stage on recognising the application of developing technologies in new products for the company, so there is an early design of product prototypes before opportunity analysis, assessment of market attractiveness, market research and financial analysis (Veryzer, 1998). Technological research is necessary to identify what is possible, before the consumer can study product ideas and develop product concepts. In the later stages, there is important design of the plant, production and the market strategy, which again needs design ideas, evaluation and then application.

Figure 3.22 indicates how new product placement can often be related to the three major components – aesthetics, technicalities and service. Placement yields more useful lines of emphasis in choosing, planning and executing activities in the product development process than just putting products into categories of industrial, consumer and food services, because of the wide

variations in products in these categories. Placement aids the selection of activities and ensures a product development process that runs smoothly and with a better probability of success.

A very important influence is the market. On the one hand for a consumer market, the influences of aesthetic factors, which persuade customers into trying a new product, can be much more significant than technical considerations. Hopefully their acceptance leads towards brand acceptance and therefore consistent support with little further effort needed on choice. On the other hand, industrial products move to a much more stringent, technical scrutiny. Careful definition of specifications, examination of pricing and longer-term contractual detail lead to dominance by technical considerations with little or no emotional overtone, and with a close eye on service and on convenience-of-fit to further processing or manufacture. Food service industries again emphasise technical detailing of ingredients, but in developing dishes and meals quite often aesthetics are a major thought; consistency, reliability and service are critical factors.

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