

From the research, the packaging is defined as packaging material (films, cardboard, metal, glass, solid plastic), packaging type (bottle, carton, pottle, can), packaging size, packaging method (hand, continuous, automatic, aseptic). The designer does not have a great deal of room for originality in food packaging except with regard to the graphic design, but there is still a great deal of originality as can be seen on the supermarket shelves. The use of computers with design software has made it easier to design packaging.

The package is then put to the test on the processing/filling line, and for shelf life, and product protection during storage and transport. Finally the consumer has to test the packaging with the product.

5.7 Process development

Process development is interwoven with product design. For example, in the Thai sausage example a standard fermentation process was chosen for the Plackett and Burnam experiments, and then in the later studies on the starter cultures, the processing variables of temperature and humidity were also studied during fermentation. The Thai sausage processing was divided into three parts: raw material preparation (mincing of meat, cooking of rice), mixing of the raw materials and stuffing into the sausage casings, and fermentation. The first two parts were kept standard throughout and only the fermentation conditions were varied.

This division of the process into its individual parts is the method used in either analysing a current process for a new product (process analysis) or for building a new process for a new product (process synthesis). The individual parts and then the connections between them are studied to give the optimal overall process. There are three aspects of studying processing: unit operations, unit processes and processing limits:

- **Unit operations.** These are the physical processes such as heating, pasteurisation, sterilisation, freezing, chilling, drying, mixing, emulsifying, tumbling, pumping, conveying, packing. They can be grouped into separation processes, assembly (or

combining) processes, conversion processes and preservation processes. There are more than a hundred unit operations used in food processing.

- **Unit processes.** These are the chemical, biological and microbiological changes such as gelatinisation, hydrolysis, oxidation, browning, protein denaturation, vitamin destruction, destruction and growth of micro-organisms, fruit ripening and meat tenderising. There are a number of these reactions occurring together in a food process and this leads to a complicated study in design. In the past much of the knowledge was empirical, but gradually basic quantitative studies of the rates of these reactions are leading to more directed process design.
- **Processing limits** (maximum and minimum). These can be temperatures, rates of increase/decrease in temperature, viscosities, mixing speeds, shear rates and pH, as well as processing times, availability and cost of equipment and services such as water quantity and steam pressures.

The combination of basic knowledge of food processing which has been built up over the last twenty years and the use of computers has led to a great deal of change in food product design and process development from the recipe testing of the past to systematic design based on process engineering principles and knowledge of food chemistry, biochemistry and microbiology.

The development steps are common in all projects, but the relative amounts of time and effort required for different steps may change considerably. Many food products are processed in more or less generic equipment so the emphasis in development lies on the product. If process development is more extensive, the logical sequence remains but the description of the steps may change, for example detailed design for items of equipment or a continuous line are included.

Think Break 5.7

Process development: allocation of time and effort for different products

Consider the relative time and effort which you would need to allocate to the various steps set out in Figures 5.1 and 5.2 when developing each of the following products:

- the risotto product (see Think Break 5.2, Section 5.3.5);
- the fruit drink powder mix (see Think Break 5.5, Section 5.4.4);
- a new frozen bar in which a soft caramel centre is surrounded with fruit ice-cream and enrobed in chocolate (see Think Break 5.6, Section 5.5 for fruit ice-cream).

5.8 Building the marketing

Consumer panels can be used during the product design to devise the best method of marketing the product; such panels build up knowledge of their relationship with the product, the acceptable price range and the product image. Distribution testing of the prototypes builds up knowledge about the physical distribution system and the market channel possibilities. Costing analysis gives an idea of the basic product and marketing costs. The marketing researchers then have a great deal of knowledge on which to build the marketing strategy.

The researchers are then able to determine:

- price range,
- relationship of the product to competitive products,
- product's position in the market,
- various market channels and their suitability for the product,
- target market segments and
- product image.

Having done this, they test the product in a large consumer test so that they can confirm the marketing method and also determine sales potential and market share.

5.8.1 Market survey

Market survey combines a number of activities whose objectives are to select the market segment(s) and the position of the product in the market segment, to determine the possible sales to the market segments, and to find information on which to base the marketing strategy. The information from the consumer research in the product design needs to be confirmed and expanded, either by secondary market research using published information and company information, or by primary market research using consumer focus groups, retail audits, and studies of the competitors and of the industry.

Focus groups may be organised to collect in-depth information on the target market, product, price, buying place, promotion, preference, preference over competitive products and long term buying predictions. Retail audits can be bought from commercial companies who regularly monitor sales of products in retail outlets, or more likely today, from the summarised information of supermarket electronic data. This information not only gives the market shares of the competing products, but continuous sales records, which can be a basis for sales forecasting. The sales of competing products need to be backed by information on the qualities of the different competing products, from either technical comparison or consumer comparison of the products, as well as on the competing companies and their methods of marketing. For industrial products, there is a need for industry studies to discover the different customers in the market and their characteristics - size, method of processing, company organisation, economic status, and present use of raw materials.

There is also a need to study the whole market channel and the physical distribution system. In consumer food marketing, the retailers have a strong control on the introduction of new products, so there is a need to study the competing products on their shelves and how they promote them, their attitudes to new products, and the effects on their new product behaviour of the prices, discounts, and promotional financing by the manufacturers. One also needs to investigate any retailers' charges to obtain shelf space for new products.

The place of the new product on the company's and the market's product life cycle is determined to ensure that a suitable marketing strategy is selected. Internally, the place of the new product in the company's product mix and product line is studied to see how the new product will affect the complete product mix and also individual products.

Think Break 5.8

Building the marketing: a new starch product

A medium sized starch company has developed a new starch product which gives a clear solution with a high viscosity and a bland taste, which can be used in soups, sauces and gravies, puddings and desserts, meat and fruit pies. Discuss the types of industrial market segments that you could use for this product and how you would conduct a market survey to determine its target market segment and the position of the product as compared with other starch products.

5.8.2 Large consumer test

Large-scale product testing of the final prototype product is undertaken by consumers, or in industrial marketing by one or two large customers in their plants or by a number of food service outlets. To obtain results for the major decision to go into commercialisation, it is usually preferable to have a statistical sample of the target market so that the accuracy of the buying prediction is known. However, the sample size is often limited by practical considerations such as the amount of money available, the time to do the test and the amount of product available.

The questions to be answered in the large-scale test include:

- Which consumers like/dislike the product?
- Do they prefer it to competing products?
- What product characteristics need improvement?
- Does the product or the packaging need to be redesigned?
- Will they buy the product at the given price?
- In what price range will they buy the product?
- How much will they buy, and how often will they buy at the different prices in the price range?

The consumer products are tested in a central location such as a shopping mall or in the home. In the ***central location test***, a stall or a caravan is set up in a central position such as a shopping mall and people passing are asked to taste the product and give their comments

on a self-administered form or in an interview. This does not give a random sample of the population but it is quicker and cheaper than the in-home test. In an *in-home test*, the consumers are given a sample of the product, either unidentified or with the full branded pack, and asked to prepare and eat it in their household. The consumer or all the members of the household can be asked to comment on the product. A problem is the timing of the test which can influence a food product. It is preferable to do the consumer test at a time of year when the product would be expected to sell but this may not be possible. If done at a low acceptance time, this must be taken into account when analysing the results.

Industrial product testing with small processors and food service outlets is very similar to the organisation of the in-home test. Sufficient product is given to the processor to try the product in their process, and to the food service chef to develop a dish to put on their menu. A restaurant may test this dish by putting it onto the blackboard menu and watching their customers' reactions to the dish. The processors and the food service outlets are usually interviewed after the test to find how the product has been used, the problems and successes with the product, the intention to buy, the acceptable prices and predicted quantities to be bought. With larger processors, pilot plant or small production trials are organised either jointly by the supplier and the buyer or often by the buying company because of secrecy.

Products for overseas countries should be tested in that country, and international companies either have their own testing facilities in those countries or contract local market research companies to conduct the research. International product testing uses the same techniques but presents problems. First there is the problem of language - the questionnaires have to be in the language of the consumers and there may be problems in translation not only into a particular language but even into a particular dialect. Definitions of products and product characteristics may be substantially different. Scaling methods may also have to be changed. For example the 9-point hedonic scale from 'like extremely' to 'dislike extremely' may not be acceptable in a culture where expressing negative opinions is socially unacceptable so the dislike terms have to be removed.

Think Break 5.9

Building the marketing: in-home testing of a baking mix and a dairy cream

Outline how you would organise an in-home test for:

- baking mix for making muffins;
- dairy cream in an aerosol can.

Decide on the questions that you want answered, how you would present the products and the packs, the target consumers, the distribution of the samples and the questionnaires.

How would you use the results?

5.9 Product and process specifications and marketing strategy

Outline process plans include raw material specifications and quantities, process flow charts and processing conditions, product quality specifications, process control points and product testing methods. From this information, product and process specifications can be written and an approximate product cost determined. If necessary, legal or governmental approval is sought for the product or/and the process. An approximate idea of the customer and consumer acceptance of the products is already known; from this and historical sales data, sales forecasts can be determined. From the consumer and market studies, the marketing strategy can developed.

5.9.1 Product and process specifications

Final specifications include the raw material specifications, the product formulation, the process flow chart, the processing conditions in the individual unit operations, a preliminary HACCP analysis of the process, the testing of the intermediate and the final products, and the final product qualities. These are based on only preliminary production runs and can change during the commercialisation.