

In Case Study 5 are some comments on food design for the future from an Italian design journal, to start you thinking about the development of food design. Certainly today there is a need to determine the direction of food design both for food ingredients and consumer products, and also for the fresh products which are being designed on the land and in the water.

Case Study 5.

Towards a Food Design

The food product development project passes from a traditional approach aiming at the adjustment of natural food, to an approach based on consumer needs, and then to an approach implying the interpretation of food technology potentialities in the framework of the food culture of eaters. Food design aims at closing the gap between what is culturally acceptable as nourishment and the extreme technological situation of foods consisting of the most artificial nutriment.

It must combine artificiality with quality by integrating into the food development project all aesthetic, sensory and symbolic dimensions, along with what has been handed down and the future developments of custom and food culture, to develop 'edible objects' detached from natural products but offering the same degree of quality and richness.

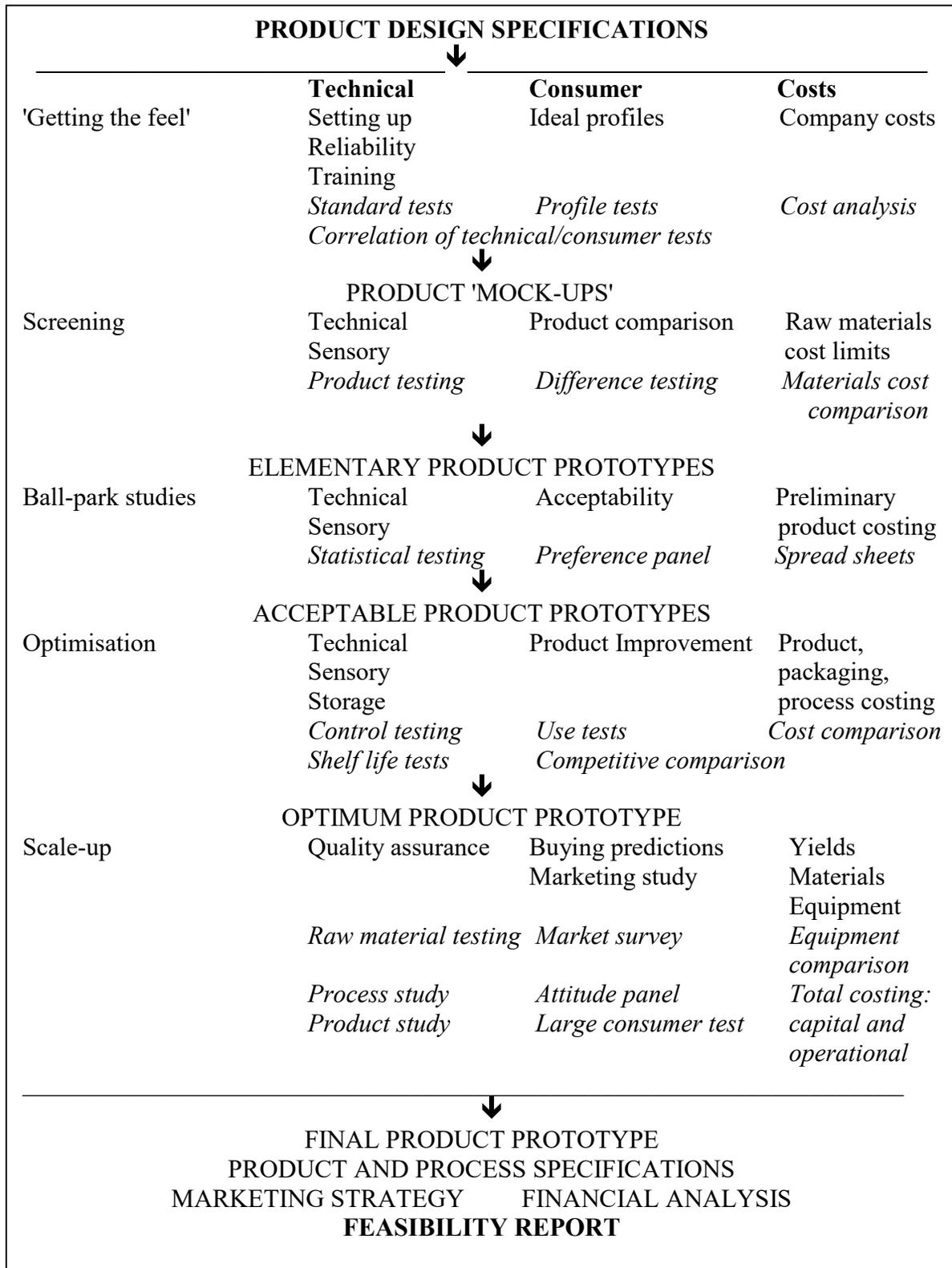
Besides, it must ensure - between those who eat and make food - a mediation, not just a formal one or based on a naturalistic food, but a deeper one, asserting the technological identity of food by seeking, in the ancestral food culture as in the chaos of present day behaviour, a poetical spirit that may make it more valuable.

(From François Jégou (1996) 'Design and food; object-food and food raw materials', *Stileindustria*, 2(6), June, pp. 40-1.)

5.4 Product testing

Product testing is an integral part of the product design and process development as can be seen in Figure 5.2.

Figure 5.2 Testing activities & techniques in product design and process development



To achieve the final product prototype, it is very important that the product is tested at all stages during its design for technical compliance, acceptability to the consumer, and compliance with cost constraints as shown in Figure 5.2. **Example 5.1** lists the types of tests used in the development of a Thai fermented sausage

Example 5.1 Testing of Thai Fermented Sausage (Nham)

In Thai sausage product design experimentation, there were:

- chemical tests (pH, total acidity, volatile acidity, residual nitrite, reducing sugars and cooked rice),
- physical tests (Instron compression, shear force and energy, reflective colour, gas formation, water activity, weight loss),
- microbiological tests (mesophilic aerobic micro-organisms, *Enterobacteriaceae*, *Staphylococcus aureus*, yeasts and moulds),
- sensory tests (appearance, texture, flavour) and tests of consumer acceptability.

The product profile characteristics were: colour, visual texture, air pockets, firmness, juiciness, smoothness, sourness, saltiness, spiciness, pork flavour.

Wiriyacharee, P.,(1990) *The systematic development of a controlled fermentation process for Nham, a Thai semi-dry sausage*, Ph.D. thesis, Massey University, New Zealand

5.4.1 Technical testing

Technical testing varies a great deal depending on the type of product, the testing facilities available, safety needs, processing needs and legal regulations. The tests can be chemical, physical or/and microbiological. The technical testing for consumer acceptance is built up from the consumers' product profile, and suitable technical test methods are sought which relate to the product characteristics identified as important to the consumer. In the early stages of product design, correlating the technical tests on the product qualities with the consumer product profile is essential. Technical testing is also required to confirm that any food regulations are being met, that consumer safety is ensured and that any labelling requirements for example nutritional value are confirmed. At the later stages, technical testing is developed to monitor the product specifications for quality assurance, and account needs to be taken of the accuracy and reliability of the results. Consideration also needs to be given to the costs of testing – Can the efficiency be improved? How much testing is needed for control of the product quality?

5.4.2 Shelf life testing

Testing shelf life is important in food design because there is usually a target shelf life to be achieved for transport and storage in the distribution chain as well for storage of the product by the consumer after buying. From previous knowledge, some predictions can be made early in the design on the possible shelf life; foods can be divided into short-life products (up to 10-14 days), medium-life products (up to eight weeks) and longer-life products (up to 1-2 years). The possible deterioration reactions in the food are identified, for example chemical reactions like browning and loss of colour, and microbial growth of food spoilage organisms, moulds and yeasts. It may be necessary to carry out accelerated tests under severe conditions to identify exactly what the deteriorative reactions are.

Shelf life testing needs to be started as soon as possible in the prototype development, usually at the start of optimisation experiments. Shelf life testing takes time and can be the critical activity controlling the completion of the project. The variables need to be identified - usually temperature, humidity and surrounding atmosphere in storage; vibration, handling and contamination in transport. Factorial designs are again used so that the quantitative effects of changes in the storage and transport conditions on product quality can be measured.

Think Break 5.3

Product testing: shelf life

The 'use by' or 'best by' dates on food products are indicative of the shelf life of foods. The shelf life is the length of time before the consumer can recognise a change in quality or the product becomes unsafe. Look at some 'best by' dates in the chilled cabinets of the supermarkets and note the 'best by' dates for different types of foods and brands. Did the information on the package include storage temperatures?

How would you use this information for setting the conditions for shelf life testing of two new products: (1) natural active yoghurt (2) vacuum packed sliced salami?

(See Lewis, H. And Dale, R.H.(2000) ‘Chilled yoghurt and other dairy desserts’ in Man, C. M. D. and Jones, A. A. (eds,), *Shelf-Life Evaluation of Foods*, 2nd. Edition, Gaithersburg, Maryland: Aspen Publishers pp.89-109.)

5.4.3 Sensory evaluation

Sensory evaluation can be carried out by expert sensory panels or by consumers.

Traditionally in product design, the expert panel determined the differences between prototypes and the direction of the differences, while consumer panels evaluated the acceptance of products or preferences between products. This meant that consumer input did not take place until the final stages of prototype development. But with the acknowledged importance of the early stages of product design, consumer panels are now used to guide the design. Such panels are used in screening the ingredients, determining the product characteristics and their strength in the ideal product, developing and optimising the product profile of the product prototypes, and optimising products for acceptance and cost. Care needs to be taken when choosing the “consumers” – are they the people who buy the product, who prepare the meal, who eat it?

A trained panel may consist of between four and ten people, but consumer panels are larger, comprising at least thirty people depending on the type of testing. The members of a trained panel after a month or longer training are able to score the product qualities reliably and accurately. Consumer panels are not trained, but are representative of the users of the product. Initially consumer panels were considered 'too much work' and expensive, but experience has shown that this is not so.

The size of the consumer panel increases throughout the design as the importance of making the right decision becomes critical and the penalty for a wrong decision becomes larger. In product formulation, it can consist of 15-20 consumers, rising to 50-100 consumers during the final processing trials and 200-300 for the final product prototype, while in some large markets with greater variability it may be even more. The smaller panels are useful when some depth of knowledge is needed though they are not a statistically valid method of determining how many people in the market will buy the product. But over the years, it has been shown that there are significant correlations between the verdicts of the consumer panel and the larger consumer test if the members of the consumer panel have been selected carefully and are representative of the market.

Consumer panels are used for seeking in-depth information about the product's characteristics and uses. The aim is to obtain as much detailed information as possible so

that informed changes can be made in the product design. The consumer panel gives opinions on all product characteristics, not just sensory qualities but others such as safety, nutrition, size, ease of use, transport, storing and convenience. They can also be involved in the design of the package. The final consumer panels test the packaged product under the conditions in which they would use it. This would normally be in their home, but sometimes because of secrecy and also the need to watch their use of the product such trials may take place in the laboratory. For example, there is a need to check: Is the pack ergonomically suitable? Does it fit their hands? Can they open it? Is the product suitable for their equipment and their abilities? Can they prepare and cook the product? Do the other people in the house like it? Is it acceptable to younger/older people, different sexes?

Think Break 5.4

Product consumer testing: dog food

A company is developing a dog food for the working dogs in the rural market. The product is a large sausage which can be stored at ambient temperatures. It is, with dog biscuits, the dogs' only food.

Outline the consumer test programme that you would organise with the dogs and their owners from the start of the product design to the final selection of the product prototype at the end of the product design.

5.4.4 Costs

Costs provide a basic criterion for controlling the design; they need to be monitored throughout development to ensure they are within the target range. At the beginning of the design, the company's cost structure and the target range of costs for the new product need to be agreed by all involved. The basic costs for producing and distributing the product can be subdivided into manufacturing costs, distribution and marketing costs and general company costs. A simple breakdown is shown in Table 5.1

Table 5.1 Basic costs for producing and distributing a product

Manufacturing costs	Raw materials cost Direct processing costs Fixed costs Plant overhead costs
Distribution and marketing costs	Physical distribution costs Market channel costs Promotion costs Sales and selling costs
General company costs	Administration costs Development costs Financing costs

Some of the manufacturing costs comprise raw materials, packaging, labour, depreciation of equipment, electricity, steam, gas, water, waste disposal and plant overheads. In many companies, during the product design and process development, the raw materials and direct processing costs are continuously determined and are part of the design. For example, in the linear programming models for product formulation there is usually either a total cost constraint for the raw materials or the aim is to minimise cost. Standard percentages or ratios on these materials and processing costs are used to predict the company costs. This has to be carried out with care, especially with innovative products or new markets where some of the marketing and distribution costs are unknown - these may be found to be too high only at the later stages of the project and prevent the launch. At the end of the product design and process development stage, there should be reasonably accurate forecasts of production and distribution costs and some indication of the probable marketing costs.

Think Break 5.5

Product testing: fruit drink powder development

Fruit drink powders are dissolved in water to give a refreshing drink. These drinks are popular with children, and are also used as cheap drinks for large parties.

1. Identify the ingredients in fruit drink powders by reading the labels on some powders available in the supermarket or by searching in the internet e.g. ‘Ingredient manufacturers turn powder into health gold’ by David Feder.

<http://www.foodprocessing.com/articles/2008/370.html> Sighted 14/11.2008.

2. Identify the important product qualities in such powdered drinks, and suggest how you might test these product qualities with laboratory testing, with trained sensory panel testing and with consumers.

3. Fruit drink powders are produced by mixing the ingredients so that they are evenly dispersed and then they are packed into sachets. Identify important factors in this processing and packing.

Outline the method you would use to develop a fruit drink powder, combining Figures 5.1 and 5.2 in one diagram.

There are three important general activities in product design: product formulation, packaging development and processing development.

5.5 Product formulation

Many food products are made by combining raw materials in specific proportions in a formulation, and research on the effects of various formulations on product qualities is common in product design.

In systematic formulation there are five steps:

- Set the product qualities required,
- Find data for the raw material compositions, qualities and costs,