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DESIGNING A GREENER PRODUCT—THE HOOVER 'NEW WAVE' WASHER RANGE

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Hoover is one of the best known manufacturers of domestic appliances in Britain and has made washing machines at its Merthyr Tydfil factory since 1948. This article discusses the creation of the Hoover New Wave range of 'green' washing machines, which were launched in 1993 after a four year programme of research, design and development and investment in new manufacturing plant costing £15 million. The New Wave range were the first products to be awarded an EU Ecolabel, having exceeded set criteria for energy, water and detergent consumption and wash performance.

The New Wave project originated in the late 1980s when Hoover found itself with a range of washing machines which were losing market share. Although the range had been updated a number of times, 'new' models relied on core designs which had not changed significantly since 1967. In 1989 Hoover felt that a completely new design was needed.

Hoover had already decided to buy in pre-coated steel for manufacture of washing machine cabinets, thus replacing the slow, labour-intensive and dirty process of welding and spray painting sheet steel. Developments in materials meant that the outer tub could now be moulded from reinforced plastics, rather than fabricated from vitreous-enamelled steel. There was therefore an opportunity to develop a new product range and simultaneously introduce new manufacturing processes.

It was also recognised that a growing number of consumers were demanding 'greener' products, and that foreign competitors had already taken a lead in this market. Zanussi, for example, in 1986 launched its 'Jetsystem' range in which the water is pumped to the top of the machine and sprayed down on the clothes instead of wetting them in the drum, thus saving water and energy.

Environmental performance was of course only one aspect of the planned new machine's appeal. Hoover wished to move 'up-market' from its traditional position in the washing machine market with its new range, and detailed market research was commissioned to define the features wanted by purchasers of washing machines in different European markets and countries.

THE 'GREEN' PRODUCT DEVELOPMENT PROCESS

Although development of the New Wave involved serious consideration of environmental factors for the first time, apart from a move from the former linear product development process to a more 'concurrent' team-based project, no changes to the product development process were required. No environmental specialists were involved and the team 'learned as it went along'. Nevertheless, the environmental objectives added some difficult design problems, whose solution was aided by the establishment of a closely-knit product development team.

At the start of the New Wave project, senior managers from Engineering, Marketing, Manufacturing and Finance met to agree the business and market specification for the new range. This was then converted into a technical specification by Engineering and Manufacturing, in consultation with Marketing.

The next step was to convert the specification into feasible design concepts. This involved three parallel tasks:

- Deciding how the machine was to be engineered and manufactured. For example, replacement of the fabricated steel outer tub by a single-piece moulded plastic tub (Figure 1) contributed to a substantial reduction in the number of parts in the machine – as was required in the specification.
- Design of the visual aspects of the machine, including consideration of ergonomic principles. In particular, the Hoover industrial design team were concerned from the outset that the new machine should have a stunning visual appearance that would enable it to stand out from competing products in the market.
- Researching how to reduce water, energy and detergent consumption.

Figure 1 Sketches comparing proposed single piece, injection-moulded polypropylene outer tub, and previous design of enamelled steel tub, fabricated from some 50 parts (Hoover)

Research and development

In order to reduce the amount of energy, water and detergent consumed by the machine Hoover asked its R&D group to conduct a feasibility study for a radically new wash process. This research produced several new concepts. These included: ‘spin-wash’ (slow-speed spins during the wash to wet the load with a reduction in water level in the tub); front-fill (the idea of filling the machine from the front and using the wash load as a filter to reduce detergent loss); ‘spray paddles’ (the idea of perforated agitator paddles in the drum to scoop up water from the base of the drum and shower it over the clothes, Figure 2a). The spray paddle concept would avoid infringing the patents on pumped systems used by Zanussi and other manufacturers (Figure 2b).

The new wash process required parallel engineering work to develop an electronic control system to allow more precise control of the wash cycle than was possible with the electro-mechanical timer traditionally used on Hoover machines. In addition the decision to use a plastic outer tub allowed a sump to be moulded in, thus allowing the drum and tub to fit more closely than previously and the machine to operate with less water (Figure 3b).

Figure 2 Diagrammatic comparison of (a) passive spray paddle system (similar to that used on Hoover machines) and (b) pumped spray system (similar to that used on Zanussi ‘Jetsystem’ and other washers)

Figure 3 (a) Traditional offset steel outer tub and inner drum arrangement compared to (b) plastic tub with moulded in sump, shows the reduced amount of water required to cover the heating element

Design development

The research concepts then had to be developed into a practical design. This involved Hoover product engineers developing and testing key elements of the conceptual machine. This work produced changes to the wash cycle to get a consistently good wash performance involving increased water levels and reduced mechanical action; an effective spray paddle system; plus several design refinements.

Figure 4 Engineering drawing of cross-section through New Wave machine produced on computer-aided design system (Hoover)

In parallel the design of the components were being finalised for manufacture, in order to reduce costs, speed assembly and improve quality. In pursuit of these aims further parts reduction was achieved by substituting snap fits for screws and other fixings on components such as the door. Finally, detailed engineering drawings were generated using a CAD system in the Hoover design office (Figure 4) .

ENVIRONMENTAL POLICY AND ECODESIGN

The original impetus for the environmental aspects of the New Wave project was the growing European market for energy and water saving washing machines. However, soon after the project had begun, Hoover senior managers began to consider what the company should do to respond to environmental issues more generally. An environmental consultancy report was commissioned in order to establish an environmental policy for Hoover. This report resulted in the Board issuing an Environmental Mission Statement in April 1990, with an Environmental Affairs Committee responsible for implementation. The Hoover Environmental Mission stated that the company aimed: 'To adopt the best practical environmental methods in the design, production, packaging, use and disposal of its products, whilst continuing to improve their benefits to the consumer.' (Hoover, 1990).

Also in 1990 the European Union announced its 'Ecolabelling' scheme, with washing machines among the initial categories of products to be labelled. Like the Hoover Environmental Mission, the Ecolabelling scheme is based on a 'cradle to grave' approach to the environmental impacts of products and, in 1991, a government-sponsored life cycle analysis study was undertaken to establish criteria for the washing machine ecolabel. The study showed that over 95% of the environmental impacts of washing machines occur during their *use* (Figure 5). This confirmed the focus at Hoover on reducing the water, energy and detergent consumption of New Wave, but also indicated other areas of environmental impact which may have had to be considered before the launch of the range; if it was to meet the ecolabel criteria. These were environmental impacts arising from production, distribution and disposal.

Figure 5 Life Cycle Analysis of washing machines, showing the percentage contribution to total environmental impacts at the product life stages from 'cradle' to 'grave' (After PA Consulting Group, 1991)

Figure 6 Pressing pre-coated steel panels for washing machine cabinets (Hoover)

Production

Use of pre-coated steel for the cabinet (Figure 6) gave Hoover major savings in energy consumption (previously required for welding and drying) and eliminated toxic

emissions of volatile organic compounds (VOCs) from the factory. But the company was careful not to claim environmental improvements until the 'export' of emissions to the supplier of the pre-coated steel had been evaluated. This subsequently showed that a real overall environmental benefit had been achieved – e.g. pre-coated steel is roll-coated involving less energy and VOC emissions than spray painting. Environmental benefits also arise from the elimination of welding and enamelling from tub manufacture, and from the reduction in the number of parts in terms of the amount of materials and energy needed to make a machine.

Distribution

Hoover examined the advantages and disadvantages of a cardboard pack versus a polystyrene pack shrink-wrapped with polythene. Both cost similar amounts and could be recycled, but the company came to the conclusion that – despite controversies about its use – polystyrene performed better and had the edge on environmental grounds, being lighter to transport and using much less water and energy to manufacture.

Disposal

A reduction in the number of fixings in the machine – adopted mainly for production reasons – would make the New Wave easier to take apart for recycling. Recycling would also be facilitated by reducing the variety of plastics used and identifying them by type.

MARKETING THE NEW WAVE

The New Wave range was first launched in February 1993, but due to a delay in introducing the Ecolabelling scheme, the award of an EU Ecolabel to the range did not occur until November 1993.

By early 1996 the Hoover New Wave range were still the only products to have been awarded an Ecolabel. Use of the Ecolabel is voluntary and, although other washing machine manufacturers have models that should qualify, they have not applied for an Ecolabel because they apparently do not consider the marketing advantage is worth the cost (ENDS, 1994). Another factor was the coming of energy labelling in mid 1996, which will be mandatory and free.

Since launch the New Wave range has sold well. Hoover believes that its environmental approach, supported by the Ecolabel, has been an important factor in the range's success, especially in the environmentally-aware German market in which the company doubled its share in 1994.

Environmental factors are less important in the UK market. In the absence of any other independent endorsement, the New Wave was initially promoted mainly on its money-saving aspects. However, in more recent sales material the 'environmental friendliness' of the range and the independent backing offered by the award of the Ecolabel are strongly featured (Figure 7). This approach recognises that the New Wave range has gained share mainly among environmentally-conscious consumers in the upper-middle segment of the UK washing machine market.

Extending the product family

The investment in the development and manufacture of the New Wave has also been employed to produce lower-priced models aimed at the volume UK market and other European markets, such as Southern Europe. By modifying the New Wave design, mainly by substituting electro-mechanical for electronic controls, Hoover developed the 'Classica' and subsequently the 'Soft Wave' ranges. These also save energy, water and detergent compared to previous models, but do not quite satisfy the ecolabel criteria because they lack features, such as spinwash, that require electronic controls. These lower-cost ranges have the same mechanical components as New Wave and are assembled on the same lines. Hoover also introduced a model called New Wave Plus (Figure 7) to compete at the top of the European market and in 1996 a lower water consumption range, called NewWave Plus 5.

Figure 7 Part of a 1995 Hoover brochure for the New Wave range, showing the top-of-the-range New Wave Plus model and the EU Ecolabel symbol

LESSONS

What lessons about green product development can be learned from the New Wave project?

The first is that any successful 'greener' product must balance environmental performance against the many other design attributes – performance, reliability, appearance, etc – wanted by the market at which the product is aimed, and do so at a competitive price. There is clearly no point in designing a highly environmentally responsible product if no one will buy it because it is too expensive, does not perform satisfactorily or looks unattractive. These various elements were included in the specification for the New Wave range from the start of its development.

Second, incorporating environmental objectives into the product development process does not require a fundamental change to that process. What seems vital is that the green product development process is carried out in a concurrent, integrated manner. Adopting a concurrent, team-based approach, such as that introduced by Hoover for the New Wave project, means that the marketing, engineering/industrial design, production, financial and environmental aspects of the product, can be considered by team members from the planning and specification stage onwards.

Third, green product development is relatively new activity, and for most companies, will involve a learning process. Hoover began the New Wave project with the aim of producing a design that would meet the growing market demand for washing machines that require less water, energy and detergent in use. Following the introduction of the Hoover Environmental Mission and the company's involvement in formulating the washing machine criteria for the EU Ecolabelling scheme, environmental impacts from the production, distribution and disposal phases of the life cycle were considered. The choice of materials and production processes for the New Wave was determined initially by performance, cost and efficiency considerations. Subsequent analysis showed that the new materials and production processes use less energy and generate fewer emissions than the previous processes. However, it is possible that had the system been designed from the start with the environment more directly in mind greater improvements might have been achieved.

Fourth, green product development is dynamic and evolutionary (Roy, 1994). Data published in *Which?* magazine (Consumers Association, 1995, 1996) and elsewhere (e.g. GEA, 1995) indicates that the New Wave is one of the best European machines

available in the mid-1990s in terms of energy consumption, and among the better machines in terms of water consumption. But other manufacturers continue to reduce the energy and water consumption of their machines, and Hoover is having to continue to develop new designs to prevent the New Wave being overtaken in environmental performance. Further reductions in the energy consumption of washing machines are technically possible, for example by improved insulation, increased motor efficiency and improved controls. For example, the New Wave has a sensor to adjust the water input according to wash load, but innovations that could further reduce water and detergent consumption include systems to match the input to suit the type, amount and dirtiness of the wash load. Although some manufacturers are introducing such systems, their general use depends on cost and commercial impact. The introduction of more radical ecodesign approaches, such as designing a long-life basic chassis which could be 'upgraded' with the latest control and motor technology at the end of its initial life (Goggin, 1994), also depend on cost and market acceptability, as well as on the effects of environmental regulation.

Finally, the greening of products cannot be fully achieved by individual companies working alone. Energy consumption, for example, depends on wash temperatures, which in turn depend on detergent formulation and consumer behaviour, given that in some countries cold water washing is common. Likewise, while the variety of plastics used in the New Wave was reduced and plastic components are marked to facilitate recycling, at present plastic components tend to be buried in land-fills rather than recycled. Individual manufacturers could set up their own recycling schemes, but in practice an effective and efficient system requires the involvement of other organisations such as local authorities and recycling firms.

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POSTSCRIPT

In May 1995 the Hoover European Appliance Group was sold by its US owners, Maytag, to the Italian white goods manufacturer, Candy. The policies and approaches outlined in this article may of course change under this new ownership.

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