VOL. 9, NO. 4, APRIL 2014 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

PRODUCT DETAILING, A KEY TO IMPLEMENTATION OF PRODUCT DESIGN CONCEPTS FOR SUSTAINABLE DESIGN

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ABSTRACT

Design detailing plays very important role in implementing the concept. In the research work proposed, the efforts are made to evolve a systematic approach to consider the various detailing aspect in the concept stage itself. The main aspects of detailing are Surface details, Functional details, Structural details, Construction details, Aesthetics details, Manufacturability details and Ergonomics details. Surface details include the texture, color, blending of different parts, etc. The functional details include the fits, movements, thicknesses, internal components, etc. Structural details include the materials, their properties, parts, etc. The construction details include modularity and stability. The aesthetic details include all the things which are externally visible to the user which also includes the form. Manufacturing details include costs estimation of manufacturing, components, assembly, production support and environmental impact. Ergonomic details include human factors for the intended use.

Keywords: product detailing, concept generation, manufacturability, aesthetic, ergonomics, human factor, sustainable design.

1. INTRODUCTION

Product development is defined as the process of creating a new product to be sold by a business or enterprise to its customers. The word *Design* refers to those activities involved in creating the styling, look and feel of the product, deciding on the product and its mechanical architecture, selecting materials and processes, and engineering the various components necessary to make the product work. The word *Development* refers collectively to the entire process of identifying a customer's need, creating a product to appeal to the need of user, and finally, testing, modifying and refining the product until it is ready for production. A product can be anything from a book, musical composition, or information service, to an engineered product such as a computer, hair dryer, or washing machine. This Paper is focused on the process of detailing of product during conceptual stage to confirm the sustainability of the product.

2. DESIGN PROCESS

The design process explained in the Figure-1. Involved two major stages

a. Conceptual design and
b. Embodiment design

a. Conceptual design

It is a process in which we initiate the design and come up with a number of design concepts and then narrow down to the single best concept. This involved the following steps

i. Identification of customer needs
ii. Problem definition
iii. Gathering information
iv. Conceptualization
v. Concept selection

b. Embodiment design

It is a process where the structural development of the design concepts takes place. It is in this phase that decisions are made on strength, material selection, size shape and spatial compatibility. Embodiment design is concerned with three major tasks - product architecture, configuration design, and parametric design

a. Product architecture
b. Configuration design
c. Parametric design

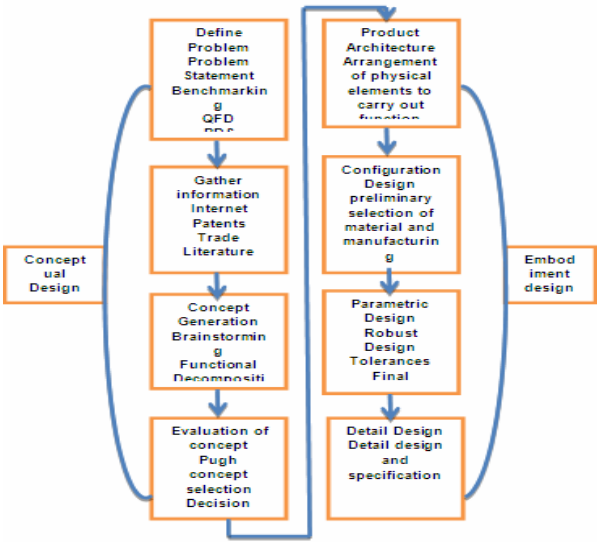

Figure-1. Schematically outlines the typical steps involved in an engineering design process.

3. PRODUCT LIFE CYCLE

Every product goes through a cycle from birth, followed by an initial growth stage, a relatively stable matured period, and finally into a declining stage that eventually ends in the death of the product as shown schematically in Figure-2.

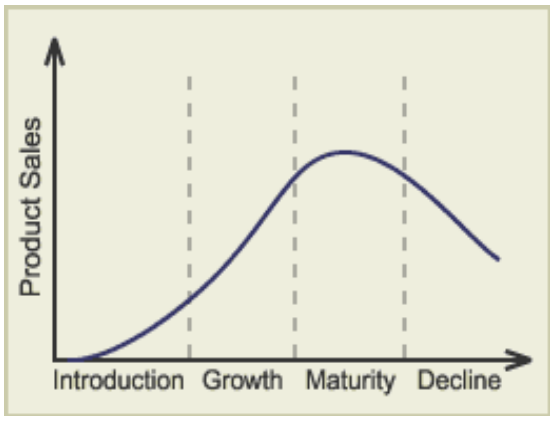

Figure-2. Schematic outline of a product life cycle.

4. PRODUCT SUSTAINABILITY

For everything that is manufactured, it makes sense to look at sustainability from the very beginning of the process, and thus the concept of eco-design has evolved over time. Eco-design has been around for years, even Dieter Rams; chief designer at Braun in the 60's and 70's included environmental considerations in his 10 principles for good design. It can be described as a simple application of life-cycle thinking from a design perspective, and the benefits of doing so can include cost savings, legislative and regulatory compliance and customer satisfaction (or PR). If a company wants to design a product with sustainability principles in mind, all it needs to do is to consider its eco-design and its life-cycle impacts and then minimizes the biggest environmental impacts identified from this analysis. This is the first step to sustainable design.

5. CONCEPT GENERATION AND EVALUATION

Concept generation and the final selection of a concept through proper evaluation are critical decision making steps in product development. The primary aim of concept generation and evaluation is to ensure that the product can perform all of the major functions. This may be done by simple calculations, sketches, circuit diagram, proof-of-concept models, or by a detailed written description of the concept. The stage of concept generation and evaluation should minimize the possibility of misrepresenting a solution, which may actually be effective, and consider different ramification of a final decision. For example, not considering the customer's need during the concept generation and evaluation phase may lead to the failure of the product in the market. Typical steps involved in concept generation and evaluation is shown below Figure-3.

6. CREATIVE THINKING

Creative thinking is critical for concept generation for a product development. The process of creative thinking can be viewed as a step to move from an unstructured idea to a well-structured, from an implicit to an explicit design. Following steps are considered helpful in encouraging effective creative thinking in the process of concept generation.

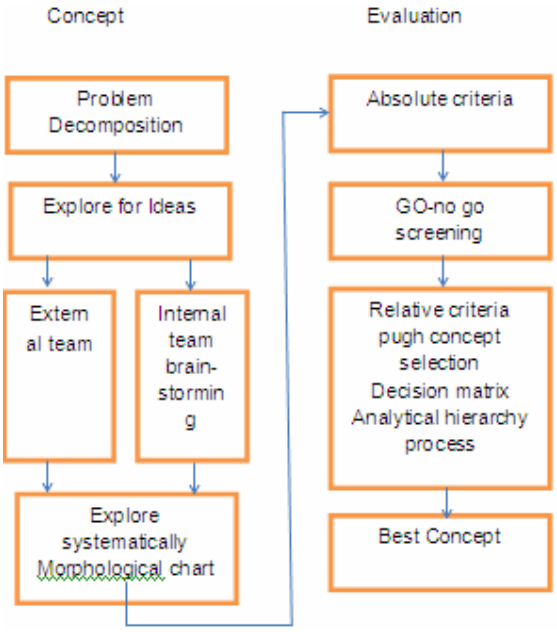

Figure-3. Various stages involved during concept generation and evaluation.

7. CONCEPTUALIZATION STAGES

i. Conceptualization for manufacturability
ii. Conceptualization for functioning
iii. Conceptualization for ergonomics

8. CONCEPT DEVELOPMENTS

Good concept development is crucial. During this stage, the needs of the target market are identified, competitive products are reviewed, product specifications are defined, a product concept is selected, an economic analysis is done, and the development project is outlined. This stage provides the foundation for the development effort, and if poorly done can undermine the entire effort. Concept development activities are normally organized according to Figure-4.

8.1. Identify customer needs

Through interviews with potential purchasers, focus groups, and by observing similar products in use, researchers identify customer needs. The list of needs will include hidden needs, needs that customers may not be aware of or problems they simply accept without question, as well as explicit needs, or needs that will most likely be reported by potential purchasers. Researchers develop the necessary information on which to base the performance,

size, weight, service life, and other specifications of the product. Customer needs and product specifications are organized into a hierarchical list with a comparative rating value given to each need and specification.

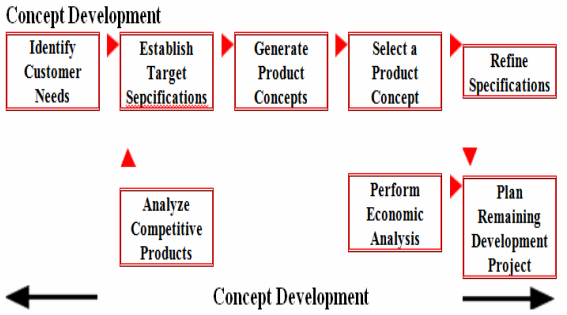

Figure-4. Concept development.

8.2. Establish target specifications

Based on customers' needs and reviews of competitive products, the team establishes the target specifications of the prospective new product. While the process of identifying customer needs is entirely a function of marketing, designers and engineers become involved in establishing target specifications. Target specifications are essentially a wish-list tempered by known technical constraints. Later, after designers have generated preliminary products concepts, the target specifications are refined to account for technical, manufacturing and economic realities.

8.3. Analyze competitive products

An analysis of competitive products is part of the process of establishing target specifications. Other products may exhibit successful design attributes that should be emulated or improved upon in the new product. And by understanding the shortfalls of competitive products, a list of improvements can be developed that will make the new product clearly superior to those of others. In a broader sense, analyzing competitive products can help orient designers and provide a starting point for design efforts. Rather than beginning from scratch and re-inventing the wheel with each new project, traditionally, the evolution of design builds on the successes and failures of prior work.

8.4. Generate product concepts

Designers and Engineers develop a number of product concepts to illustrate what types of products are both technically feasible and would best meets the requirements of the target specifications. Engineers develop preliminary concepts for the architecture of the product, and industrial designers develop renderings to show styling and layout alternatives. After narrowing the selection, non-functional appearance models are built of candidate designs.

9. CONCEPTUALIZATION AND SUSTAINABILITY

There are various factors to be considered for the conceptualization. Consideration of these factors during concept building has great impact on the sustainable product. These factors can be classified as below.

10. DESIGN DETAILING-TOOLS AND TECHNIQUES

10.1. Product detailing tools

There are a number of product detailing tools and techniques that can be used to design products more sustainably, and the right technique will depend on each company's aims and objectives. For example, if a company is looking to reduce its carbon footprint, then it would make sense to look at "Design for embedded carbon" and review the material selection, or look at "Design for transport efficiency", as the distribution of the product may well cause the biggest production of carbon. However, if a company has set targets for moving to 100% recyclable packaging, then it would need to look at "Design for recyclability" and move towards using mono materials that can easily be separated at point of disposal and recycled in most local authorities' collection streams. Companies need to be careful, however, when transporting packaging or products abroad that the materials can be readily recycled at their destination. A few of the techniques commonly used for minimizing environmental impact are outlined below. Packaging eco-design techniques design for embedded carbon look at the material used in the product or its packaging; for example, using Aluminum that is made from 60% recycled content can reduce the product's embedded carbon by up to 90%.

10.2. Detailing for recyclability

Consider the detailing for recyclability of the materials from which the product or packaging is made Minimize the different types of materials used and, if possible, move to a single material product then detail out how the materials are fixed together; for example, moving from screws to snap clips reduces the amount of time it takes to dismantle the product and they could also be made from the same material.

10.3. Detailing for recycled content

Most modern product can include high levels of recycled material content, for example cardboard boxes, metals and most plastics. An obvious and commonly-used example is the Innocent Drinks bottle; one of the first to be made from 100% recycled PET. By understanding the material behavior product can be detail out so as can often be used effectively and money can be saved.

10.4. Detailing for bio-degradability or compost ability

Does the consumer have the ability to compost? If so, moving to biodegradable packaging (which is suitable for home composting) can minimize the impact of the packaging at the end of its life However, care must be taken and the company needs to ensure that the packaging

really will be composted. The EU Landfill Directive sets demanding targets to reduce the amount of biodegradable municipal waste going to landfill, one of the reasons being this type of material can increase methane and CO_2 production by up to 20 times.

10.5. Detailing for transport efficiency

The product detailing can contribute in to design so that product can be stackable or more products fit onto one pallet. The product detailing can contribute in a way that packaging be designed to interlock or stack in a different way to allow more products to stack together. Detailing can contribute in shelf-ready packaging be introduced, thus eliminating the need for secondary and transit packaging and therefore fitting more products together in one pack?

11. PRODUCT DETAILING TECHNIQUES

11.1. Detailing for concentration

If a product contains water, for example cleaning products, paints, coatings or drinks, it can be concentrated so the consumer can mix it with water at its destination. The detailing can play a major role in designing so that smaller (and cheaper) packaging, lower transport and storage costs and a longer lifespan of the product.

11.2. Detailing for longevity

Historically, some companies have been accused of planned obsolescence, which is deliberately planning or designing a product with a limited useful life, so that it will become obsolete or nonfunctional after a certain period to ensure consumers re-purchase products Most designers are, however, now moving away from inbuilt obsolescence and looking at whether the product can be detailed designed to last longer, for example a kitchen knife with 2 blades, so that, once the user cannot re-sharpen the first blade satisfactorily, the blade can be swapped and the blunt one sent back to the manufacturer to be professionally sharpened. Another example is that of a washing re-programmable machine, so that when a new washing powder is released that allows consumers to wash at a lower temperature, a new programme can be uploaded that sets the temperature to the new level

11.3. Detailing for energy efficiency

Products that use energy are starting to be covered by new regulations (under the European Energy Using Products Directive) which set out eco-design requirements, mostly to do with energy efficiency in use. Therefore, manufacturers are starting to have to document and reduce the energy used in standby, on and powered-down modes All of the above can (and should) be considered during the design stage of any product or packaging. A good way to do this is to undertake a workshop, inviting representatives from all the different sections of the business, from marketers, production managers and environmental managers to the senior management to attend and contribute. Brainstorming with these different staff together, looking at product lines as specific examples and building short, medium and long term plans for improvements, quite often identifies projects where low cost / no cost changes can save vast amounts of money. It is worth remembering that, although external consultants can often add value by providing additional advice and expertise and by helping to facilitate the workshop discussion, no-one knows a company better than its own staff.

11.4. Detailing green consumption

The green consumer market grew by 15% in 2008, whereas the overall Figure for the consumer market growth was nearer 1.4%, with estimates on sustainable food up by 14%, sustainable textiles up 71%, green stationery up 49% and even eco-friendly funerals up by 18% now is the ideal time for companies to grow by producing and marketing more sustainable products.

12. CONCLUSIONS

Terms like eco-design, design for sustainability, carbon foot printing and life-cycle thinking all sound very technical and complex when first looking at the sustainability of a product, service or process. However, all these terms have roughly the same meaning and use similar approaches to identifying potential improvements in the design of “greener” products, packaging and services. In simple terms, they all suggest that the entire life-cycle of the product should be considered during detailing of any product and this will usually include the added benefit of identifying where costs are highest and where easy financial savings can be made. After all detail design must also be about conceptualization and imagination of designer.

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