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Research Paper

The Role of Product Design Concept: A Bird Eye View

Engineering

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ABSTRACT

Concurrent Engineering (CE) has a great deal of importance in design and development of new products in automobile industry and is posing a big challenge to Indian firms in the wake of globalization. Product design is the process of creating a new product to be sold by a business to its customers.A very broad concept, it is essentially the efficient and effective generation and development of ideas through a process that leads to new products.Success of CE demands that major areas of product design and development of an organization need to be under constant focus Most of the companies adopt CE procedures to reduce the time of launching the new product in the market, especially firms of western countries and Middle East. Product design is cross-functional, knowledge-intensive work that has become increasingly important in today's fast-paced, globally competitive environment. It is a key strategic activity in many firms because new products contribute significantly to sales revenue. When firms are able to develop distinctive products, they have opportunities to command premium pricing. Product design is a critical factor in organizational success because it sets the characteristics, features, and performance of the service or good that consumers demand. The objective of product design is to create a good or service with excellent functional utility and sales appeal at an acceptable cost and within a reasonable time.

Introduction:

Product design is an essential activity for firms competing in a global environment. Product design drives organizational success because it directly and significantly impacts nearly all of the critical determinants for success. Customers demand greater product variety and are quick to shift to new, innovative, full-featured products. In addition, customers make purchase decisions based on a growing list of factors that are affected by product design. Previously, customers made purchase decisions based primarily on product price and/or quality. While these factors are still important, customers are adding other dimensions such as customizability, order-to-delivery time, product safety, and ease and cost of maintenance. Environmental concerns are expanding to include impacts during production, during the product's operating life, and at the end of its life (recycle-ability). In addition, customers demand greater protection from defective products, which leads to lower product liability losses. Safer and longer lasting products lead to enhanced warrantee provision, which, in turn, impact customer satisfaction and warrantee repair costs.

Concept Development

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

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.

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.

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.

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.

Select a Product Concept: Through the process of evaluation and tradeoffs between attributes, a final concept is selected. The selection process may be confined to the team and key executives within the company, or customers may be polled for their input. Candidate appearance models are often used for additional market research; to obtain feedback from certain key customers, or as a centerpiece of focus groups.

Refine Product Specifications: In this stage, product specifications are refined on the basis of input from the foregoing activities. Final specifications are the result of tradeoffs made between technical feasibility, expected service life, projected selling price, and the financial limitations of the development project. With a new luggage product, for example, consumers may want a product that is lightweight, inexpensive, attractive, and with the ability to expand to carry varying amounts of luggage. Unfortunately, the mechanism needed for the expandable feature will increase the selling price, add weight to the product, and introduce a mechanism that has the potential for failure. Consequently, the team must choose

between a heavier, more costly product, or one that does not have the expandable feature. When product attributes are in conflict, or when the technical challenge or higher selling price of a particular feature outweighs its benefits, the specification may be dropped or modified in favor of other benefits.

Perform Economic Analysis: Throughout the foregoing activities, important economic implications regarding development expenses, manufacturing costs, and selling price have been estimated. A thorough economic analysis of the product and the required development effort is necessary in order to define the remainder of the development project. An economic model of the product and a review of anticipated development expenses in relation to expected benefits is now developed.

Plan the Remaining Development Project: In this final stage of concept development, the team prepares a detailed development plan which includes a list of activities, the necessary resources and expenses, and a development schedule with milestones for tracking progress.

System Level Design
System-level design, or the task of designing the architecture of the product, is the subject of this stage. In prior stages, the team was focused on the core product idea, and the prospective design was largely based on overviews rather than in-depth design and engineering. Once the development plan is approved, marketing may begin to develop ideas for additional product options and add-ons, or perhaps an extended product family. Designers and engineers develop the product architecture in detail, and manufacturing determines which components should be made and which should be purchased, and identifies the necessary suppliers.

The product architecture defines the product in *chunks,* or the primary functional systems and subsystems, and how these systems are arranged to work as a unit. For example, an automobile is comprised of a body and a chassis with an engine, a transmission, final drive, frame, suspension and braking system. The architecture of an automobile design determines the platform layout, whether the vehicle is front-wheel-drive or rear-wheel-drive, the size and location of the engine, transmission and final drive, the overall design of suspension system, and the layout and type of other necessary subsystems such as brakes, wheels, and steering. The architecture may determine the layout of the exhaust system, but it would not provide the detailed engineering needed to determine the diameter and thickness of the exhaust pipe, the detailed design of mufflers, nor the engineering of motor mounts and exhaust hangers needed to isolate vibrations from the passenger compartment.

The architecture of the product, how it is divided into chunks and how the chunks are integrated into the total product, impacts a number of important attributes such as standardization of components, modularity, options for change later on, ease of manufacture, and how the development project is divided into manageable tasks and expenses. If a family of products or upgrades and add-ons are planned, the architecture of the product would determine the commonality of components and the ease with which upgrades and add-ons can be installed. A system or subsystem borrowed from another product within the company›s line will economize on development, tooling and manufacturing costs. With outsourced components, the supplier may contribute much of the associated design and engineering.

Testing and Refinement
During the testing and refinement stage, a number of prototypes are built and tested. Even though they are not made from production components, prototypes emulate production products as closely as possible. These *alpha* prototypes are necessary to determine whether the performance of the product matches the specifications, and to uncover design shortfalls and gain in-the-field experience with the product in use. Later, *beta* prototypes are built from the first production components received from suppliers.

Production Ramp-up
During production ramp-up, the work force is trained as the first products are being assembled. The comparatively slow product build provides time to work out any remaining problems with supplier components, fabrication, and assembly procedures. The staff and supervisory team is organized, beginning with a core team, and line workers are trained by assembling production units.

Technology-Push Products
The generic development process is used with technology-push products, but with slight modification. With technology-push products, the company acquires or develops a new technology and then looks for appropriate markets in which to apply the technology. Consequently, an extra phase is added at the beginning during which the new technology is matched to an appropriate market opportunity. When the match has been made, the generic development process is carried out as described.

Models and Prototypes
The terms *prototype* and *model* are often used interchangeably to mean any full-scale pre-production representation of a design, whether functional or not. I prefer to use the term *model* to describe a non-functional representation and the term *prototype* to describe a functional item. An *appearance model* is a full-scale, non-functional representation that looks, as closely as possible, identical to the prospective new product. Modeling and prototyping serve a variety of purposes throughout the development effort.

Conclusion:
While there has certainly always been an inherent understanding that the look of a product contributes to its success in the marketplace, lately the business community's appreciation for product design and its impact on the bottom line has grown. In 1991 Business Week proposed that, "recently, business has grown increasingly aware that design sells. U.S. companies, in particular, are rediscovering that good design translates into quality products, greater market share, and heftier profits" .More recently, the press takes it for granted that businesses understand the importance of good product design. The authors of these articles as well as others. Product quality parity has become the norm in many categories; manufacturers have looked to design as a way of differentiating their goods. Despite the recognition of the significance of design in the business community

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