THE INFLUENCE OF MARKETING ON THE DESIGN OF FLUID-POWER PRODUCTS

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ABSTRACT: Marketing should play a major role in the design of new fluid power products. The wants, needs and problems of the consumer are many times ignored as important inputs to product design. Without the use of marketing information, products can develop that are not competitive in the marketplace by failing to meet the needs of consumers.

This paper describes the role of marketing in product design and emphasizes the interaction and exchange of ideas between engineering, industrial design, and marketing. Such a market-oriented approach produces products that practically sell themselves. Applying this approach to the design of fluid-power products should have a tremendous, positive effect on the industry as a whole.

KEY WORDS: marketing, design, fluid power, components, systems, consumer, customer, product development, product design, product modification, industrial design, market research, market orientation

INTRODUCTION

The design of new products, especially those targeted towards industrial markets, is often the sole domain of design engineers and industrial designers. A quick review of marketing literature reveals that marketing should play a major role in the design of new products through the guidelines provided by marketing research on consumer's wants, needs, and problems. Yet, in most companies, the role of marketing in product design has been and still is quite limited. The purpose of this paper is to communicate to design engineers and industrial designers the importance of marketing involvement in the design of products in the fluid-power industry.

THE MARKETING CONCEPT

A new philosophy has evolved in the marketing community since World War II that has been commonly called the "marketing concept" [1]. More and more businesses view the marketing concept or satisfying the needs of consumers as the primary starting point for all marketing activities. The marketing concept replaces a formerly held business belief that personal selling and advertising were the major means of increasing profits [1]. Note, however, that the evolution of the marketing concept is still going on, with some companies further along than others [2].

Exactly what does the marketing concept involve? For the business organization, the marketing concept involves communicating with customers to find out their needs and product requirements, and determining what kind of product would be best received by the consumer. In the fluid-power industry consumer needs might be special safety features or increased component versatility and reliability. With this information, the company can create and design products that satisfy customers. But the process must continue. The company must alter and adapt product designs to keep pace with changes in customers' desires and preferences. The marketing concept is a complete management philosophy that stresses the importance of customers and emphasizes that marketing activities begin and end with them.

THE MARKETING MIX

Marketing is defined as the composite of four major disciplines interacting to produce the most optimal result for the business organization [1]. These four disciplines are known as the "marketing mix" and consist of product, price, distribution, and promotion. The product element of the marketing mix should receive the most attention by company management [2]. A poor product can rarely be overridden by increased emphasis on the remaining elements. Whereas, a strong product element often can prevail overriding inherent weaknesses in the other elements.

DEVELOPMENT OF NEW PRODUCTS

For most companies, the development and introduction of new products are frequently expensive and risky. Also, the of time required to get a new product to the marketplace can be extensive—it took sixteen years to research and introduce the first automatic transmission

[1]. To avoid any unnecessary waste of expense or time, alternative products must be carefully screened before a new product is chosen. Engineering and marketing objectives for new products should include both those products that best satisfy customers' needs and those that will provide the best return on investment [3], Fig. 1. To accomplish this, close scrutiny of the engieering features of alternative designs must be considered [4].

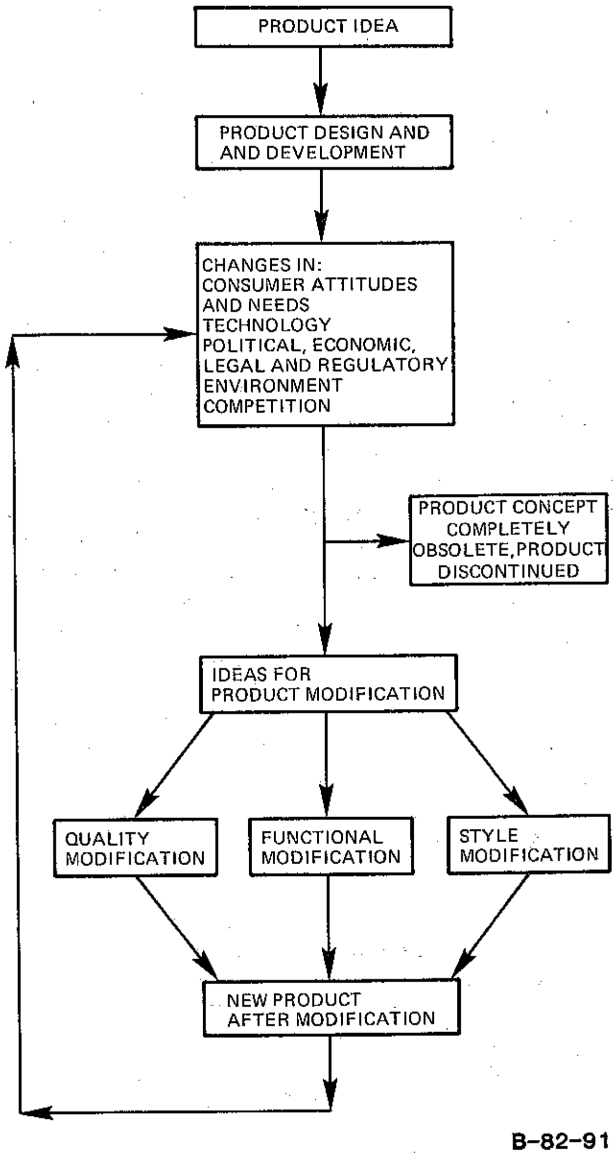

Fig. 1. Design Phases of a Product's Life Cycle.

- What does the product provide the customer—new function, improved function, lower costs?
- How does its design relate to safety, time savings, appearance, or other customer benefits?
- Is the product an isolated item or part of a family—what is its scope?
- What effect will legal, association, or governmental influences have on the product's design?
- Will there be special design requirements for international markets?
- Are there better, alternative methods to accomplish the design objectives?
- Will there be installation or servicing problems associated with the product?
- Will the product have application limitations and, if so, could these be sales deterrents?

Once a new product is effectively introduced into the marketplace, the best way to stay ahead of the competition is to stay ahead of the needs and requirements of the consumer. This fact is often taken for granted by many company managers and is consequently often underestimated as an effective means of extending a product's life cycle. Therefore, one of the most important steps in the product planning process is product updating and modification. The approach of modifying or altering a company's existing products is much less risky and costly than developing new products. There are three major ways a company can change existing products—quality modifications, functional modifications, and style modifications [1], Table 1.

Quality modifications are changes that relate to a product's durability and reliability and are usually accomplished by making alterations to the materials, production process employed, or both. However, changes that affect a product's versatility, effectiveness, convenience, or safety are called functional modifications and usually require redesigning various parts of the product. Certain fluid-power products might be modified to better satisfy consumers quality and functional requirements if the material strength of hoses, seals, or pump housing were increased. Reliability and safety could be increased by minimizing contaminant sensitivity and adding backups and redundancy to fluid-power systems. However, the exact modifications employed should not be merely an engineering or management decision based on unsupported beliefs about what the customer will buy. But rather, these modifications should occur as a result of direct communication with the customers, reflecting their current and future product requirements. Also, new technology can be an effective tool in providing new product features and in overcoming previously insurmountable problems.

Style modifications are directed at changing the sensory appeal of a product by altering its texture, sound, shape, color, and smell. Through style modifications, a company can differentiate its product from competing brands as well as influence a customer's impression of it. By modifying the shape and color of one company's heavy

QUALITY MODIFICATIONS	FUNCTIONAL MODIFICATIONS	STYLE MODIFICATIONS
Increase hose strength through change of materials.	Increase a product's ease of operations by modifying the design of its controls.	Modify shape and color to make the product appear rugged and durable.
Decrease contaminant wear through the use of abrasive resistant materials.	Design changes that improve response time and smooth movement.	Modify product to provide a family appearance and easy company identification.
	Design changes that decrease maintenance requirements.	
	Changes that enable faster failure diagnosis and provide for component exchange.	
	Design valves and other components for lower contaminant sensitivity.	

Table 1. Fluid-Power Design Modifications.

hydraulic equipment, it can appear more rugged and durable than competing brands. Style modifications can additionally influence a customer's opinion of an equipment's reliability, ease of operation, and safety.

Obtaining the necessary information to answer all the questions about the design and development of new products or the modifications of existing ones is difficult. A company must actively seek out marketing research information, analysis of socio-economic trends, and sales and market data to have the desired level of confidence in its products' design [5]. For without this information, a program of consumer-oriented marketing would be impossible.

THE DESIGN PROCESS

Almost everything mass-produced in industry today is generally the result of the combined efforts of the engineer and the industrial designer. The engineer is called upon to solve particular problems in hydraulics and electronics, while the industrial designer contributes his skills in areas of materials usage, ergonomics, styling, and value engineering [6]. However, the role of marketing in the product design process is not clearly defined in most companies. Yet, marketing should be a major contributing factor in the creation and design of new products and the modification of existing ones. It is important that the precise interrelationships be understood between design engineers, industrial designers, and marketing. This can best be accomplished by taking a look at the design process [7], Fig. 2.

Project Definition Phase

During this phase of the design process, basic project objectives are outlined. Engineering and marketing representatives should meet to discuss what is needed and to develop preliminary functional specifications for the proposed project. This is also a good time for the industrial designer to become involved while the concept is still flexible enough to be readily influenced. Marketing should provide valuable input on various consumers' attitudes including general market potential relative to development objectives. Additionally, marketing can make important contributions on corporate direction and philosophy to help reflect a consistent company image in the product design. Input received by engineering and industrial design in the form of advice and consultation by marketing will be valuable in developing a working plan to coordinate further design activities.

Some of the items that need to be considered in the project definition phase are use of common, interchangeable component parts with other existing machines, safety and serviceability, control and ease of operation features, energy usage requirements, reliability and service life, and manufacturing considerations. Also, preliminary industrial design parameters on assembly and appearance should be brought forth at this time. Competitive reviews by engineering, industrial design, and marketing can help provide valuable insight on how to design the proposed product in relationship to its competition. This information will be important in setting guidelines.

Project Development Phase

During the development phase, engineering and industrial design work closely together to prepare equipment layouts and to select the size, location, and type of various components such as reservoirs, pump/motors, radiators, transmissions, and operator location and cab configuration. The engineer would typically provide the preliminary layout that the industrial designer will use as a guide to make design suggestions on appearance or other industrial design objectives. The process repeats

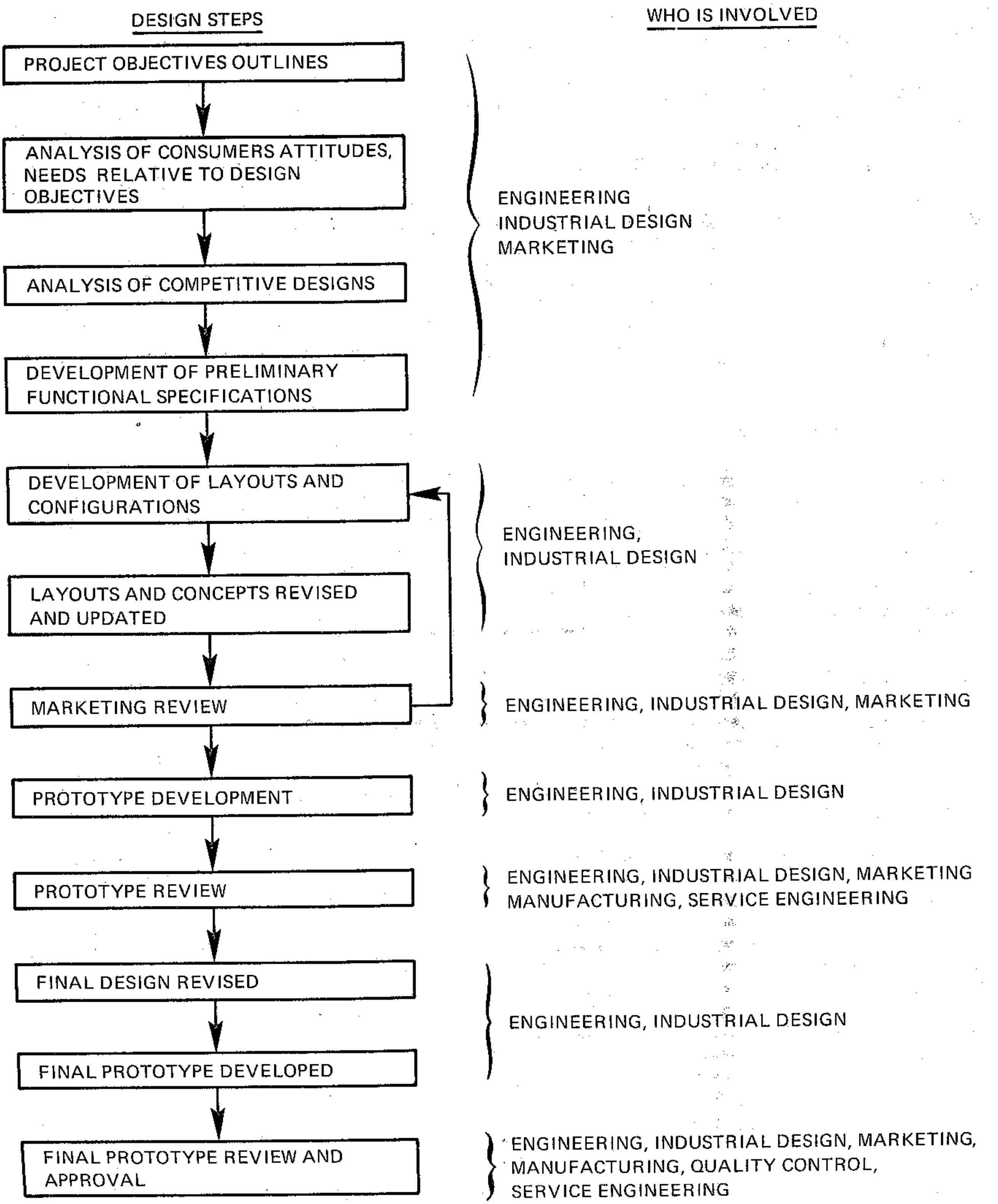

Fig. 2. The Design Process.

itself as layouts become more detailed and concepts are revised and updated.

At various stages of the development phase, meetings are held with marketing to discuss possible consumer attitudes about the equipment and the design features being considered. Once the design has progressed to the point where a scale model or prototype can be built, complete reviews or audits with members of engineering, marketing, manufacturing, and service engineering will be necessary. Only when a viewer can walk around, climb on and off of, and sit in or on a scale model can human factors and other marketplace considerations be accurately assessed. The evaluation of sight and visibility lines for the operator, the fitting of components, assembly and serviceability can all be more clearly analyzed. Now is the time when valuable suggestions can be made to provide a more consumer-oriented product.

However, the marketing involvement in the development phase is not restricted to mechanical or production aspects of the product. During this stage, the other components of the marketing mix must be developed for testing [1]. Marketing must have a thorough understanding of the product's design to begin work on copyrights, trademarks, preliminary advertising copy, packaging, and labeling to determine all legal ramifications. Also, plans for personal selling and distribution must be made at this time to ensure integration of every element in the marketing mix.

Final Design Phase

During the final design phase, second generation prototypes incorporating the latest engineering and industrial design features are reviewed and evaluated by engineering, marketing, manufacturing, quality control, and service people. Once these prototypes are judged satisfactory to each group's approval, the result should be a well-engineered, consumer-oriented product, ready for production.

DESIGNING CONSUMER-ORIENTED FLUID-POWER PRODUCTS

Designing fluid-power products with the consumer in mind means designing products that will be easy to sell and will command repeat purchases. The consumer must believe that the equipment he bought was a good investment. And in an industry where repeat sales are a necessity, consumers are not going to purchase additional units unless they are completely satisfied with their initial purchase. To adequately address marketing influences on fluid-power product design, it is essential to consider the major consumer problems with fluid-power products [8].

Ease of Operation

Machine and heavy equipment operators are often a mobile group, moving rapidly from job to job. As a result, contractors and foremen face the difficulties associated with frequent personnel changes. This means that machine controls must be easy to reach and easy to operate. Operator productivity increases when only one control lever is used to operate several functions. Also, the pattern in which the controls operate must make logical sense in relation to the corresponding direction of machine movement.

Important to the ease of which fluid-power equipment operates is the system's reaction time and shift speeds as well as flow rates for multiple hydraulic systems on the same machine. Problems in these areas have a significant influence on how smooth a machine operates. This is something that the consumer will find out before he buys. Most equipment dealers allow potential customers to take a machine through its normal operating cycle. If the controls do not feel good and the equipment does not respond quickly and smoothly, then the customer is not likely to buy.

Maintenance

Maintenance is a major user problem with fluid-power machinery. One solution is to eliminate as many daily maintenance points possible and group the rest into one or two locations for easy accessibility. On some equipment, it is necessary to check the fluid levels on the engine oil, transmission oil, hydraulic oil, brake fluid, and differential oil. The need to frequently perform all these checks makes maintenance difficult. Additionally, each system might require a different kind of fluid that increases the chance of runouts in the user's stock. More reliable flashing light dash indicators and audible alarms to alert the operator of high temperatures or low pressures in the engine, transmission, hydraulic, and breaking systems are also needed.

Repairs

As labor rates go up, more customers are buying fluid-power equipment that is easy to work on. This is achieved by designing equipment to accommodate minor repairs with hand tools by unskilled mechanics. Reducing repair time for the customer is an area where product design can play a major role. Designing equipment that enables faster failure diagnosis and provides for component exchange is an effective means of reducing user downtime. Diagnosis of machine failures can be made faster by providing more test ports on hydraulic systems which helps isolate components so that they can be tested independently. It is common for experienced mechanics to spend more time looking for the problem than repairing it.

Fluid-power equipment designed for easy component exchange enables equipment to continue operating while repairs are being made. This is not a new concept in industry but it is one that is still not being completely utilized in the design of many fluid-power products. If a failed component can not be removed and replaced with a new or rebuilt component, then the machine will remain inoperative until the repair can be made.

Aesthetic Appeal

The importance of appearance should not be underestimated. Many customers will simply not buy a machine if it does not look rugged enough. Also, machinery from one manufacturer should have the family appearance. Many customers buy what others buy, making product identification an important promotional tool. Most users are proud of the appearance of their equipment.

Safe Operation

Design of fluid-power equipment for safe operation works in favor of any manufacturer. The threat of highly publicized product-liability suits, that can do more damage to a company's image and to the success of a product than anything else, can be minimized through safety awareness in product design [9]. And, the fluid-power industry is by no means immune [10].

A major safety problem in fluid-power systems that causes pump and valve failure is contaminant wear. Machine operations that rely on fluid controlled by valves can exhibit unpredictable behavior when contaminant wear occurs. The use of components designed to protect the fluid from contamination can alleviate such problems.

One of the incessant safety problems in fluid-power systems is hose failure. Selecting the wrong hose in the system's design is a leading cause. The selection of certain hoses can be a poor choice if the pressure or temperature is too high, if the fluid is incompatible with hose material, if the flow through the hose liner is excessive, if the hose receives repeated harsh pressure surges, and if the hose is required to flex beyond its fatigue limit.

The poor selection of seals in components can significantly increase the safety risk in fluid-power products. Designs that provide for maintaining sealing surface finishes, eliminating the intrusion of contaminants, and resisting geometric distortion will minimize this risk.

CONCLUSION

The importance of marketing influences on the design of all products should not be underestimated. Through marketing, product designers are able to better understand the needs of customers and then react to those needs. The design of fluid-power products demands a strong customer orientation to be competitive in a highly competitive industry. The design process requires the constant interaction and exchange of ideas between engineering, industrial design, and marketing. Such a design process produces products that practically sell themselves. Applying this type of market-oriented approach to the design of fluid-power products should have a tremendous, positive effect on the industry as a whole.

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