

A REVIEW ON PRODUCTION DESIGN FOR BATCH PRODUCTION OF MANUAL GROUNDNUT DECORTICATOR

Amit Sharma¹, Dr. Yogesh Agrawal²

¹P.G scholar, Department of Mechanical Engineering, SIRTE, Bhopal

²Professor & Head, Department of Mechanical Engineering, SIRTE, Bhopal

Abstract- India is one of the largest producers of groundnut in the world. About 7.5 million hectares is put under it annually and the production is about 6 million tonnes. Groundnut kernels are used mostly for producing cooking oil in addition to using them in the form of snacks.

The groundnut crop after drying has pods, which need to be shelled for taking the kernel out and it is the kernel of groundnut which is used for human consumption. Decortication involves breaking of shells and removal of seeds. A groundnut decorticator separates kernels from pods. The separation of shell from the kernel is known as decortication and a range of decorticating machines are available which are suitable for small-scale production. The Central Institute of Agricultural Engineering Bhopal has developed a working prototype of manual groundnut decorticator which has become very popular among the local farmers and small scale processors.

I. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) also known as peanut is believed to be the native of Brazil to Peru, Argentina and Ghana, from where it was introduced into Jamaica, Cuba and other West Indies islands. The plant was introduced by Portuguese into Africa from where it was introduced into North America. It was introduced into India during the first half of the sixteenth century from one of the Pacific islands of China, where it was introduced earlier from either Central America or South America.

The major groundnut-producing countries of the world are India, China, Nigeria, Senegal, Sudan, Burma and the USA. Out of the total area of 18.9 million hectares and the total production of 17.8 million tonnes in the world, these countries account for 69% of the area and 70% of the production. India occupies the position, both in regard to the area and the production, in the world. About 7.5 million hectares is put under it annually and the production is about 6 million tonnes. 70% of the

area and 75% of the production are concentrated in the four states of Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka. Andhra Pradesh, Tamil Nadu, Karnataka and Orissa have irrigated area forms about 6% of the total groundnut area in India [1].

II. LITERATURE REVIEW

Product development is the process of creating a new product to be sold by a business or enterprise to its customers. In the document title, Design refers to those activities involved in creating the styling, look and feel of the product, deciding on the product's mechanical architecture, selecting materials and processes, and engineering the various components necessary to make the product work. Development refers collectively to the entire process of identifying a market opportunity, creating a product to appeal to the identified market, and finally, testing, modifying and refining the product until it is ready for production. A product can be any item from a book, musical composition, or information service, to an engineered product such as a computer, hair dryer, or washing machine [25].

The task of developing outstanding new products is difficult, time-consuming, and costly. People who have never been involved in a development effort are astounded by the amount of time and money that goes into a new product. Great products are not simply designed, but instead they evolve over time through countless hours of research, analysis, design studies, engineering and prototyping efforts, and finally, testing, modifying, and re-testing until the design has been perfected.

Few products are developed by a single individual working alone. It is unlikely that one individual will have the necessary skills in marketing, industrial design, mechanical and electronic engineering, manufacturing processes and materials, tool-making, packaging design, graphic art, and project management, just to name the primary areas of expertise. Development is normally done by a project team, and the team leader draws on

talent in a variety of disciplines, often from both outside and inside the company. As a general rule, the cost of a development effort is a factor of the number of people involved and the time required to nurture the initial concept into a fully-refined product. Rarely can a production-ready product be developed in less than one year, and some projects can take three to five years to complete.

The impetus for a new product normally comes from a perceived market opportunity or from the development of a new technology. Consequently, new products are broadly categorized as either *market-pull* products or *technology-push* products. With a market-pull product, the marketing center of the company first determines that sales could be increased if a new product were designed to appeal to a particular segment of its customers. Engineering is then be asked to determine the technical feasibility of the new product idea.

This interaction is reversed with a technology-push product. When a technical breakthrough opens the way for a new product, marketing then attempts to determine the idea's prospects in the marketplace. In many cases, the technology itself may not actually point to a particular product, but instead, to new capabilities and benefits that could be packaged in a variety of ways

to create a number of different products. Marketing would have the responsibility of determining how the technology should be packaged to have the greatest appeal to its customers. With either scenario, manufacturing is responsible for estimating the cost of building the prospective new product, and their estimations are used to project a selling price and estimate the potential profit for the company [26].

The process of developing new products varies between companies, and even between products within the same company. Regardless of organizational differences, a good new product is the result a methodical development effort with well defined product specifications and project goals. [27]

III. 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 according to Figure 3.1.

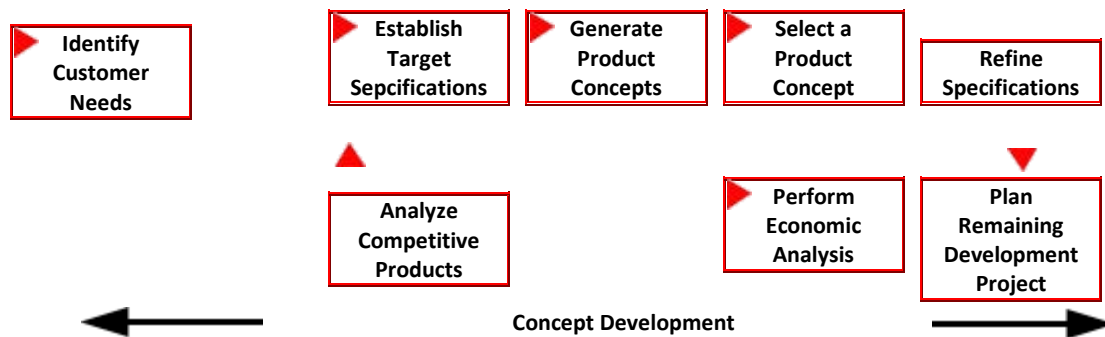


Fig. 3.1 Concept Development

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 [28].

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 meet 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 [29]

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.



PRODUCT DESIGN

Product design is a strategic decision as the image and profit earning capacity of a small firm depends largely on product design. Once the product to be produced is decided by the entrepreneur the next step is to prepare its design. Product design consists of form and function. The form designing includes decisions regarding its shape, size, color and appearance of the product. The functional design involves the working conditions of the product. Once a product is designed, it prevails for a long time therefore various factors are to be considered before designing it. These factors are listed below: -

- (a) Standardization
- (b) Reliability
- (c) Maintainability
- (d) Servicing
- (e) Reproducibility
- (f) Sustainability
- (g) Product simplification
- (h) Quality Commensuration with cost
- (i) Product value
- (j) Consumer quality
- (k) Needs and tastes of consumers.

Above all, the product design should be dictated by the market demand. It is an important decision and therefore the entrepreneur should pay due effort, time, energy and attention in order to get the best results.

Design of Production System: Production system is the framework within which the production activities of an enterprise take place. Manufacturing process is the conversion process through which inputs are converted into outputs. An appropriate designing of production system ensures the coordination of various production operations. There is no single pattern of production system which is universally applicable to all types of production system varies from one enterprise to another.

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