Ain Shams University
Faculty of Engineering
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QUALITY ANALYSIS IN THE PACKAGING INDUSTRY

Submitted

By

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SUBERVISED BY

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STATEMENT

This dissertation is submitted to Ain Shams University in partial fulfillment for the degree of Master of Science in Mechanical Engineering.

The Work included in this thesis was carried out by the author in the department of Design and Production Engineering, Ain Shams University from October, 2010 to April, 2015.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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ABSTRACT

Packaging today plays an important role in the quality of all products and goods by providing protection from environmental, chemical, and physical challenges. Today, packaging's role is being expanded to include branding, communication, distribution control, anti-counterfeiting, poison protection and much more. The objective of this thesis is to emphasize the quality function through the packaging industry and to introduce the various elements of such quality function to this prominent industry. To achieve this objective, a 4 step model is proposed This includes :-

1. Management
2. Design
3. Raw material
4. Process Control and Improvement

KEYWORDS

Packaging
Quality Control
Quality Management
Total Quality Control

Summary

Packaging is not a recent phenomenon. It is an activity closely associated with the evolution of society and, as such, can be traced back to the human beginnings. The nature, degree, and amount of packaging at any stage of a society's growth reflect the needs, cultural patterns, material availability, and technology level of that society.

Packaging is a multidisciplinary function and borrows from many fields of science and engineering including organic and inorganic chemistry; metallurgy; mechanical, industrial, chemical and electronic engineering; nuclear science; physics; mathematics; microbiology; toxicology; art and design, and more .

Packaging function in Egypt can be considered a weak link in the national economy. A lot of many locally manufactured products are poorly presented, it has been reported that there has been a significant percentage of losses in both processed goods and agro products due to inadequate packaging. Some exported shipments from Egypt were refused and returned back by their buyers and some important deals are completely lost due to inefficient packaging.

The objective of this work is to emphasize the quality function through the packaging industry and to introduce the various elements of such quality function to this prominent industry.

The work in this thesis is presented through eight chapters:

1. Chapter 1.Introduction.
2. Chapter 2.Historical Review
3. Chapter 3.Literature Review
4. Chapter 4.Managing the Packaging Function.
5. Chapter 5.Quality In Package Design.
6. Chapter 6.Quality of Packaging Materials.
7. Chapter 7.Process Control and improvement.
8. Chapter 8.Conclusions and Recommendations.

The proposed model to achieve the objective of this thesis is given through the main four chapters; from chapter 4 to chapter 7. The basic four elements of this proposed model is outlined in the following:

1) Managing The Packaging Function

To "Managing quality through the packaging function", the following main points should be analyzed:

- Identifying the packaging functions.
- Managing testing programs.
- Managing the packaging process.
- Design of the quality system.
- Waste management.

2) Quality In Package Design

The analysis to "Quality in Package Design" is given into seven main clauses:

1. Application of Design Control
2. Successful Package Design
3. Fundamental Design Messages
4. Package Design Function
5. Package Design "Graphic Basics"
6. Package Design "Printing"
7. Design for Distribution Packaging

3) Quality Of Packaging Materials

After new-design control activity has resulted in the specification of a well-designed product, incoming-material control techniques take over the task of seeing that materials of the proper quality will be available for use during actual manufacture of the new product.

Many types of materials, and components, are purchased by packaging companies and contribute to the ultimate end quality product in use. These materials, parts, and assemblies may include metal plates, paper, wood, plastics, glass,..etc. With today's increasingly complex products, the quality of these purchased materials becomes increasingly important.

Quality-control activity on incoming material falls in eight fundamental steps within the total quality program:

1. Material request and material specification.
2. Purchase analysis.
3. Vendor selection.
4. Material receipt.
5. Material examination.
6. Material disposal.
7. Record keeping and follow-through
8. Vendor relations and vendor surveillance

4) Process Control and Improvement

Packaging industry consists of a vast array of industries. It is a collection of many manufacturing industries to produce different types of packages. It also represents a service industry to contain, protect and transport goods and products from the production centers to where the consumers are at various locations using the most efficient and effective ways and methods.

Hence, process control and improvement in the packaging industry can be classified according to these two types of industries, i.e. manufacturing and service industries.

Packaging as a Manufacturing Industry

To achieve process control and improvement in any of these cases depends on the properties of the packaging material used, the manufacturing process adopted and the selected technique to be used for analyzing the data obtained.

Packaging as a Service Industry

This depends on the basic objective of packaging industry as a service industry to contain, protect and transport goods and product using the most efficient and effective ways and methods as described above.

The required steps needed to achieve process control and improvement may be summarized in the following:

- Define and document the service requirement.
- Build the service requirement into each activity.
- Measure service requirement into each activity.
- Take corrective action and verify results.

Contents

Chapter 1
Introduction

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Introduction

Packaging industry consists of a vast array of industries. It is a collection of many manufacturing industries to produce different types of packages. It also represents a service industry to contain, protect and transport goods and products from the production centers to where the consumers are at various locations using the most efficient and effective ways and methods.

Packaging, in one sense, could be viewed as an industry for all industries. It is fascinating, challenging, controversial, highly technical, and always changing.

Packaging function cannot exist by itself; it needs a product. If there is no product, there is no need for a package. The product and the package have become so interdependent that we cannot consider one without the other.

One Insurance Company in USA estimates that fully 75% of international cargo losses are preventable, much of them through better packaging systems. In less-developed countries, food loss between producer and consumer can be as high as 45%; unfortunately, in some instances this represents the difference between self-sufficiency and starvation (85).

Some idea of the magnitude of packaging's share in economy is revealed by the fact that annual expenditures worldwide are said to measure more than $238 billion (41).

Packaging is being required to do more and more in many areas. In the past, its essential roles were containment and protection of the product. In many cases, the company and the consumer paid little attention to the package. Today, packaging’s role is being expanded to include branding,

communication, distribution control, anti-counterfeiting, poison protection, and much more (54).

Packaging has emerged as both a science and an engineering discipline that has influence on a product, both within the producing company and with the consumer outside the company. The science portion of this mix is a broad combination of disciplines. It includes polymer science, material science, and analytical chemistry to name a few.

Packaging today plays an important role in the quality of all products by providing protection from environmental, chemical, and physical challenges. This protection can be as simple as preventing breakage of the product to providing barriers to moisture, oxygen, carbon dioxide, and other gases as well as flavors and aromas. Packaging can block light to protect nutrients and colors in a product from deteriorating. In addition to providing passive protection, many packages today play an active role in the quality of a product by helping to maintain a desired atmosphere around the product. Packaging materials have the three primary functions of providing protection, utility, and communication.

Packaging is best described as a coordinated system of preparing goods for transport , distribution , storage retailing , and use .It is a complex , scientific , artistic and controversial business function.

Packaging functions range from those that are technical in nature to those that marketing oriented, Figure (1.1). Technical packaging professionals need science and engineering skills, while marketing professionals need artistic and motivational understanding. Packaging mangers need a basic understanding of both marketing and technical needs, mixed with good business sense. This unusual skill spread makes the packaging industry a unique one (85,83).

Because the science of packaging is closely connected to everything we

do as a society, it should come as no surprise that the packaging industry is always in state of change.

Technical Functions ⟷		**Marketing Functions**	
Contain	Measure	Communicate	Promote
Protect	Dispense	Display	Sell
Preserve	Store	Inform	Motivate

Figure 1.1 Packaging encompasses functions ranging from the purely technical to those that are marketing related in nature.

1.1 Packaging Chain

The major three groups of components in the packaging chain (clusters), which require the attention of national packaging development efforts and international technical support are (88):

1. Design and packaging making industries ***(Packaging Manufacturing Cluster)***. This can be classified on basis of respective main materials, namely paper and board, plastics, glass, metals and wood. It also includes converting industries, printing and flexible lamination.The manufacturing cluster should guarantee regular availability of competitively priced packaging materials with international standards of quality and environmental requirements.

2. Packaging/filling/wrapping/packing activities/industries ***(Packaging Users Cluster)***. It includes or is closely related to most of the production sectors, almost the totality of the food (including fresh products) and consumer products as well as most of the industrial products. The packaging users cluster should be able to have packages properly structured and printed to withstand physical distribution