KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

EXPLORING THE CONCEPT OF STANDOUT IN STRUCTURAL PACKAGING-CHALLENGES AND PROSPECTS IN GHANA.

by

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DECLARATION

I, Samuel Osei Sarpong, declare that this submission is my own work towards the MCOMM and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

Often times, packaging is the first and only marketing tool consumers encounter before a purchase. It is therefore considered the most important communication and informative tool. The issue of packaging in Ghana at present is very pressing, owing to the fact that, as a developing country, the manufacturing industry is now taking shape and as a result, there are many locally-made products whose packages compared to their foreign counterparts need to be improved, especially with regard to their structures to enable them compete with their foreign counterparts. For this reason, there are many good quality products made in Ghana whose patronage, even on the local market is low.

This study, " Exploring the Concept of Standout in Packaging Structures - Prospects and Opportunities in Ghana" sought to offer alternative design solutions to structural packages offered on the local market. It sought to address the issue regarding the fact that Ghanaian consumers generally prefer imported products to similar locally-made brands, and patronise the former mainly because of the high quality and attractive-looking nature of their packaging and not always because they may be of a higher quality. Products such as wood carvings, food, textile products, soaps like the '*Azumah Blow' soap*, '*Alata Samina'*, native sandals, toffees and chewing stick, among others were explored and alternative packages designed for them.

This research sought to:

1. Design and create sample packaging structures of locally made products
2. Assess the impact of the packaging structures

The qualitative approach was adopted for the study, using interviews and questionnaires. Data gathered from the questionnaires revealed that 55.0% of the respondents consider it unnecessary the look of the structural packaging of their products. They maintained that it is the content of the product they are concerned with and not the packaging structure. 40%, however, were of the view that the structural design of a product is very essential to the marketability of their products and therefore sought the assistance of the researcher in that regard. 5.0% of the people interviewed were indifferent on the issue. They were of the opinion that a product, be it packaged or not was not an issue to them, and that they will be attracted to good structures anyway.

Finally, recommendations were made regarding the outcome of the research.

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DEDICATION

I dedicate this work to the memory of my late father, Chief Inspector Kofi Sarpong, my mother, Mrs. Rebecca Sarpong, to all my siblings and to the Department of Communication Design, KNUST.

CHAPTER ONE

Background to the Study

In recent years packaging has developed well beyond its original function as merely of product protection, and now plays a key marketing role in developing shelf-appeal, providing product information, and establishing brand image and awareness.

Structural packaging refers to packaging's three-dimensional formats in all its different guises; cartons, bottles, jars, tubs, tubes, blister and skin packs, metals, wood and so on.

The structure of the packaging design is ultimately a significant partner to the silent salesperson that sells itself on the shelf right next to other competitors, since it is the consumer's initial experience with the product; the structural design of the package is responsible for this crucial introduction.

"A proprietary, or "ownable," packaging structure (via unique shapes, materials, and dispensing systems) has become the norm (or even the cost of entry) in many categories—and structural packaging innovation has been the primary driving factor in revitalizing brands and entire product categories" (Young, 2004).

As the competition in structural packaging the world over gains momentum, so will research into this arena become increasingly important, given the potential for structural packaging to successfully achieve marketing goals. One needs to fully understand the role that packaging structures play in a marketing environment, and how best to leverage this tool to influence consumers. If packaging structures are so important, what will be the best way to measure its effectiveness?

There is the need, therefore, to critically explore the concept of standout in packaging with greater emphasis on its structure, to increase patronage of Ghanaian products.

The History of Packaging

The prehistoric man cared less about packaging. This was due to the fact that commodities were consumed in their raw states either on the spot or sometimes carried to their abodes or caves in their bare hands. It is also probably because society had not developed to the extent that there was no competition as regards the manufacture and sale of products. With evolution, however, packaging in one form or other developed gradually.

The most significant era of packaging is when man started keeping some of his wares in leaves, gourds and shells as containers, endowed by nature. The oldest information on manufactured package available to the research dated as far back as 1844 when paper production was introduced in Europe. What necessitated the use of manufactured package could be linked primarily to transportation and agglomeration ("History of Packaging", 2006). Packaging started in a different form from what we know today. The earliest form was by the use of animal skins, shells, broad leaves and hard "skin" fruits and vegetables. Liquids were stored in containers made from animal skins, hollowed out logs, gourds, coconuts and shells. In Ghana, most food made of corn, such as the "Ga kenkey" (komi) and "nkyekyera‟ of the Asantes for example, are still wrapped in corn husk to this day. Foodstuffs were and are still carried from the farm to market places or homes in woven palm fronds called "Bɛdɛ" in the Twi language. From this, it may be concluded that packaging is not new to Ghanaians. Branded packaging is however, fairly new in Ghana (Essuman, 2008)

In the Ancient Egypt and Roman Empires, materials such as clay were used as containers. Glass, metal and paper were later introduced upon their invention and therefore used for packaging. Butter and cheese were kept in baskets, vinegar in barrels, and tea in chests whilst grains were put in sacks during the Victorian times (Hook & Heimlich, 2007).

The first ever branded package was introduced in England in 1746 by one Dr. Robert James who packaged his "Fever-Powder" in a box for retailing (Ariev, 2007). Other people followed suit by introducing other forms of packaging by using 12 different materials such as metal and glass. A. F. Pears, an Englishman established the first soap packaging company (Ariev, 2007). Yardley of London also packaged his famous lavender water in glass bottles, whilst Crosse and Blackwell also branded olive oil and mustard in jars (Ariev, 2007).

Packaging as a method for food preservation began in the latter part of the 16th century. In 1795, when the French War was raging, there was an urgent need for food preservation for soldiers in the war. As a result, food had to be canned. The famous French warrior Napoleon Bonaparte realizing the need to preserve and transport food to his army, offered a prize to reward anyone who could find answers to his demands. In 1809, one Nicholas Appert, a confectioner, invented the process of canning by introducing an airtight glass jar to win the prize. By this, he introduced canning which was further developed to the light weight cans of today (Hook & Heimlich, 2007).

Canned product was first used by the army before it came to the consumer's domain. The British Army first used the canned food during the Crimean wars (1853 – 1865); In the American Civil war (1861 – 1865) the militant groups used these bulky cans for food preservation and transportation. It is interesting to note that light cans that we have today and are easy to open used to be bulky and required the use of hammer and chisel for opening when it was first introduced Product packaging became very important during the World Wars. Therefore, the author finds this contradictory to Herdeg (1961) assertion that the problem of packaging may appear of a relatively little importance to people when they face problems that involve their survival. The author is of the view that although war is bad but

this development of food product packaging is one good thing that was initiated by the demands of war at that period in history. The 19th century was the period when advancements in canning and paper containers fabrications we use today got started. The packaging industry at that time availed itself with the development of mechanical printing processes, photoengraving and process colour printing. Many packages were decorated using the printing processes to make them more attractive to the buyers, to bear the names of the products and their manufacturers' information. This marked the beginning of packaging, branding and labelling.

Statement of the Problem

Patronage of Ghanaian manufactured goods has been hampered by the perception that most made-in-Ghana goods are of inferior quality due to poor packaging. Packaging and labeling of Ghanaian product lack the quality that can make them competitive on any market. Although some of the locally made products are considered to be of high quality and unique to the country, they are not accepted as good packaged products to enable them to be sold successfully, especially outside the local market (Institute of Packaging Ghana (IOPG) Situational Analysis Report, 2014). As earlier stated in the background to this study, packaging has developed well beyond its original function as merely a means of product protection, and now plays a key marketing role: developing on shelf appeal, providing product information and establishing brand image and awareness. The structure (look) of the package in recent times plays a major role in the marketability of the product notwithstanding the quality of the contents of the product. There is no doubt that Ghanaian consumers generally prefer imported foreign products from countries which are more advanced with regard to packaging such as India, China, Malaysia, Indonesia, Thailand, South Africa, The Far East, Nigeria and Europe to similar locally-made brands, and patronise the former mainly

because of the high quality and attractive-looking nature of their packaging which are also relatively affordable. According to the Situational Analysis Report of IOPG (2014), one key challenge being faced by the packaging industry in Ghana is weak quality and structural design due to low skills in packaging technology and expertise in packaging design. This does not help local manufacturers and the country loses foreign revenue as a result. It is for the reasons above that the researcher seeks to ‘’Explore the concept of standout in packaging’’ with greater emphasis on their structures or fabricated forms to increase patronage of Ghanaian products. ‘Standout’ as used here refers to having an irresistible presence due to attractiveness of structure or look. Products to be looked at include food products like plantain chips, gari, dough nut, wood carvings and textile products as well as toiletries like the "*Azumah Blow*", "*Alata Samina*", etc.

Objectives

The project seeks to:

1. Design and create sample packaging structures of locally made products
2. Assess the impact of the packaging structures

Research Questions

1. What innovative shapes could the structure of packages be made into to improve packaging in Ghana?

2. What are the challenges in the local packaging industry with regard to their structures?

3. To what extent does the structure of a product affect patronage of the product?

Delimitation

This study is limited to consumer products packaged locally by Ghanaian manufacturers. Thus, products whose packages require structural design, decoration and labelling as required by the regulatory authorities of the packaging industry. These include food products such as plantain chips, gari, dough nut, wood carvings and textile products as well as toiletries like the "*Azumah Blow*", "*Alata Samina*", etc. The study will make use of available existing data on the packaging material properties where possible to support a claim or make a claim. It will, however, not include packaging material sciences. Although this work will have an overview of the popular packaging materials used in Ghana, it will, however, focus on structures using paper, so as to enable the researcher create alternative packages with ease. This is because the researcher will not have to use heavy equipment as is the case with other materials like glass and metals.

Definition of terms

Consumers - Those individuals who use goods or services to satisfy their individual needs and desires, rather than to resell or use them as raw materials.

ISO - International Organisation for Standardisation

Labelling - The use of textual information on a product's package to instruct and to inform those who interact with the product.

Packaging - The materials in which objects are wrapped or contained before being conveyed or sold. In economic sense, packaging is industrial and marketing technique for containing, protecting, identifying, and facilitating the sale and distribution of products.

Structural Packaging: The look or appearance of a container for containing products

Standout: Attractive look or Presence

PNDCL - Provisional National Defence Council Law.

Abbreviations

GEPC - Ghana Export Promotions Council.

ISO - International Standards Organisation.

IOPG - Institute of Packaging, Ghana

SMEs - Small and Medium Scale Enterprises

WTO - World Trade Organisation.

GSA- Ghana Standards Authority

FDA- Food and Drugs Authority

GMP: Good Manufacturing Practices

Importance of the Study

"Man shows that he is affected by appearance, by something that causes him pleasure over and above the immediate utility of the object" (Clay, 1908).

This research is geared towards finding some solutions to major problems affecting the quality of product packaging in the Small and Medium Scale Enterprises with regard to their packaging structures. It seeks to bring to bear the need for manufacturers to go beyond merely labelling the product but going a step further to improve upon the structural designs of the packages. The study would therefore enable manufacturers to package their products professionally and attractively to meet the taste of their target market. This research would

serve as a guide for design and testing of consumer packaged products. It will also serve as a body of reference for packaging designers, teachers and students of packaging design and construction.

Research Methodology

The researcher will use the qualitative research method with interviews and questionnaires. A case study of locally made packages such as wood carvings, kente, toiletries like the "*Azumah Blow*", "*Alata Samina*", etc., among others.

Sampling techniques and Description

The sampling technique to be used is the convenience sampling. This method of sampling selects out of the population, the most convenient for the researcher to work with, considering the period within which the research is to be completed.

Research instruments

Interviews and questionnaires were the main instruments used. This is because these instruments are key with qualitative researches.

Facilities

1. Main Library, KNUST
2. The Ghana Export Promotions Council (GEPC)
3. The Institute of Packaging Ghana (IOPG)
4. Ghana Standards Authority (GSA)
5. Food and Drugs Authority (FDA)
6. Local Manufacturers

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Whether one likes it or not, packaging has become part of our daily lives. Packaged products are found all over the world. The global packaging market is currently valued at $597billion and is estimated to reach $820billion by 2016. Consumers are increasingly demanding higher quality packaging for products which has in turn increased the role of packaging in the sale of goods and services (IOPG Situational Analysis Report, January 2014). Packages come in such forms as packaged foods, canned drinks, and bottled water, etc. Packaging helps consumers know the contents of products, and serve as instruction guides. Manufacturing and expiry dates, warning symbols, net weight, country of origin, recyclable symbol, company's address and nutritional facts are all very essential facts that, through packaging are provided the consumer. Packaging, structural packaging for that matter, gives aesthetic delight and satisfaction, and also tactile pleasure.

Definition of Packaging

Packaging has numerous functions and more than equal the number of definitions. Soroka (1996) described packaging as a coordinated system of preparing goods for transport, distribution, storage, sale, and use. He further stated that, it is a complex, dynamic, scientific, artistic, and controversial business function, which in its most fundamental form contains, protects/preserves, provides convenience, and informs/sells, within acceptable environmental constraints. This definition seems to be broad and thus talks about what really goes into packaging the product. It is a service function that cannot exist by itself; it does need a product. If there is no product, there is no need for a pack. The complex nature of packaging is seen in the fact that, there are a number of aspects which have to be in harmony so that one side should not be in conflict with the other. For instance, manufacturers should not concern

themselves with only the container that is supposed to protect the product since the concern is on getting the product to the final consumer as a whole. They need to consider the labelling, shape and structural aspects of packaging, etc. Packaging is seen to be dynamic because it deals with human beings whose tastes keep changing. Next, it is scientific, because there is a substantial degree of chemical interaction between the container and its contents. It has aesthetic values, because the right colours must be used to attract the consumer and also the label must communicate to the ultimate consumer. This is the holistic approach to packaging. However, care should be taken not to put too much focus on one aspect to the neglect of the others, because a perfect blend is needed if the product is to perform all the right functions.

Without the proper packaging mix, the needed or expected increase in sales would not be realized. For instance, if the charges are deemed fair and preferences rightly anticipated and incorporated into the design for the packaging, but the scientific or technical aspects are neglected, the product would not even get to the consumer to satisfy the anticipated changes in taste. Again, regardless of the attractive nature of the packaging, it has to communicate the right message so as to sustain its market share and possibly increase it.

William & Weilbercher (1979) defined packaging as, 'A broadcast commercial opportunity offered for sale at a particular time for a particular price'. This definition is skewed by just looking at packaging as 'Advertising'. The emphasis is on the final product since it would be sold for a price without taking into consideration its safe delivery. However, how it would attract and sustain consumption and even whether consumers are prepared to buy at that price were not considered. Hanlon (1971) supports this critic by saying this about packaging:' In its more familiar forms, it is the box on the grocers' shelf and the wrapper on a candy bar. It can also be the crate around a machine or a bulk container for chemicals. 'It is an art and

science',- Hanlon (1971), He further went on to group packaging into three broad categories requiring different technologies and talents for their consumer packaging concerns small units in large numbers and often decorated in an attractive manner. Category two, being Industrial packaging usually made up of larger and heavier units and category three, covering military packaging which is a highly influenced by the government to document it in a more intricate way (such as using military codes).

Milton (1991) looks at packaging as not just a support for advertising but advertising itself, stating that '... While advertising may alert a large number of potential consumers to a product's existence, it is only at the point of purchase that the promotion story and the products image come together' (Milton, 1991).

Milton's view to some extent has been generalized and equated packaging to advertising but then the product should be packed before advertising sets in. In other words he tries to place value on the package as a sales tool, which is the backbone of this study.

Some other authors look at packaging in the light of the distributive process. For instance, Paine (1961) defined packaging as a means of ensuring the safe delivery of a product to the ultimate consumer in sound condition at the minimum overall cost. This definition by Paine takes into consideration only the protective functions and the cost of packaging. This line of argument is supported by Davis (1967) when he defined packaging as a collective term for all kinds of containers in which goods are packed for sale to the consumer. Thus, dwelling much on the container in which the product is packed and forgetting all the other important functions that a package performs. The above definition is criticised on the basis that in as much as getting the product safely delivered to the shelves is important; the product speaks

for its self while on the shelves to enable its purchase. It is, however, accepted by the Institute of Packaging Ghana, which gave the same definition in their Situational Analysis Report (2014). Consumers must be able to distinguish a product from other competing products and know exactly how to use the product so that it does not cause any unintended harm. Hence, the definition by Judd, Aalders & Melis (1989) which sees packaging as a sales agent or "a silent salesman" or a dispenser, after it has completed its function of delivering the product, is well placed. This definition is more appropriate for manufacturers since the cost minimization is a key business principle.

Hanlon (1971) also considered packaging in the sense of the container. To him packaging is any structure that contains or limits its content. This would include crates, nets and cocoons, as well as displays, utensils and conveyance. Hanlon looks at packaging only as a structural thing with or without any visual appeal and also takes into consideration the type of materials used in the manufacture. How it would be advertised or promoted in terms of cost, the laws governing the packaging industry as well as even how it would be conveyed to the final consumer are, however, not considered.

Byett*et al* (1997) defined packaging as an item's physical container, label and insert. In the Encyclopaedia Britannica (2003), it is also seen as the technology and art of preparing a commodity for convenient transport, storage, and sale. These two definitions are similar in scope. Packaging is indeed the physical container that is able to conveniently protect the product contents through the transportation and distribution stages, and has a well-designed label which gives all vital information about the product and most importantly looks attractive. The importance of the package leading to the sale of the product is the focus of this study.

Marketing Essentials (2003) makes an emphatic statement about the sales function of packaging. It states that a package does much more than hold a product – it is a selling tool. It added that companies take great care in designing or redesigning packages for their products to increase sales. It concluded that, packaging actually serves many purposes, ranging from product protection to attracting customers' attention. It is also a selling tool that should promote and sell the product by catching customers 'attention, defining a product's identity, and providing information, ensuring safe use, and protecting the product.

Packaging is also the interface between the product and the consumer. It is the expression of the brand identity of the product, its intrinsic qualities, and its "philosophy" Packaging is the voice of the product, its dress-sense and its "look". It is the product's first sales pitch, which is of key importance to its market positioning. Packaging's physical proximity brings it closer to consumers who look at it, lift it up for a closer look, read it, handle it, take it home and use it. The form, colours and texture of packaging provoke sensations in the consumer. In a word, it is the spokesperson of the product. (ITO Journal 2009).

Advertisers use packaging as a selling point and as a means of creating a brand image. An all-embracing definition is the one by Leonard (1980) – 'A package consists of both structure and appearance'. Clearly packaging as defined here considers both the structural aspect thus whatever contains the product as well as the appearance of the product. This definition by Leonard has been adopted for the study. This definition is very much linked to this study because as was defined in the problem statement, the structure and the labelling of packaging has not been totally realised in terms of Ghanaian products reaching the right standards.

Package Design

Package design is the activity of conceiving and ensuring that packages achieve two overall objectives: safe delivery and ability to communicate its sales message. Package design, therefore, comprises all aspects of the systematic approach to ensuring that the package achieves its two principal goals: delivering the product to the customer in perfect condition for its intended use, and providing both effective sales promotion and all necessary information throughout the distribution chain and to the user. (Essuman, 2008).

From the above objectives, it presupposes that a package must look attractive, that is aesthetically-pleasing. Thus, designs of the graphics should be able to attract and sustain the consumer's interest so as to first get the market, and then maintain and improve upon them. Besides, its contents must arrive intact. The structure or container must be able to withstand wear -and-tear, the transportation and distribution processes, and protect the product's contents from any ingress or contamination. In essence, packaging design is a vital element for sustainable market competitiveness. Package design is made up of structural design and graphic design as illustrated below.

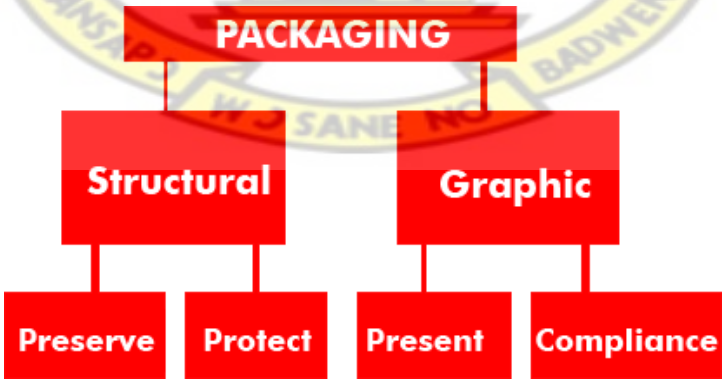


Fig. 1.1: The Composition of Package design and functions

Structural Design

A structure is basically something that has been made or built from different parts that are joined together to form an object. A package's structure refers to the three-dimensional container used for keeping products. For example, some perfume bottles have been designed in the same shape as the name of the perfume, perhaps in the shape of a dove or a dancer. A box designed for hot chocolate could have a lid that has been moulded into the shape of chocolate slabs. It makes the product far more interesting and helps the consumer to imagine how tasty and 'chocolatey' the drink will be. Packaging structures do not only facilitate the protection, transportation and storage of the products, but also help to boost sales by catching consumers' attention. Though structures are very important in the packaging industry, they are normally ignored and less emphasis placed on them. Rather, more attention is given to the graphic design.

Structural design is the engineering of package structures to meet functional and performance objectives such as to protect the product's contents from contamination, bad weather, and to preserve the product. Structural design is largely undertaken by package manufacturing and converting companies who employ specialists such as mechanical, chemical, industrial and production engineers with the knowledge and skills to conceive and adapt packaging structures that can be manufactured economically and at the same time meet all the performance standards emanating from distribution around the globe. Structural designers often operate in a specific material sector such as glass containers, paper containers (cartons), metal cans, bottles, cotton/jute bags or wooden pallets (TIEPIK, 2005).

Graphic Design

Graphic design on the other hand is the creation of a package appearance that will achieve intended communication and promotional goals. The package is today, perhaps the most powerful weapon in a supplier's marketing and sales promotion armoury. Only the package, perhaps accompanied by 'point-of-sale' promotional material, is present as a 'silent salesperson' at the moment of purchasing decision. Packaging design is a major component in the marketing campaign. It is often considered as the most important and critical sales promotional tool (Essuman, 2008). In rapidly changing sales environments, with increasing competition, rising costs and diminished effectiveness of advertising, packaging has emerged as the primary medium for delivering marketing messages. While pack shape, size, colour and convenience features can all play a part in encouraging purchase, the primary messages are normally delivered by a package's text and illustration. It is for this reason that, so much attention and resources are now devoted to the perfecting of package appearance.

Graphic design and structural design go hand in hand: good packaging design combines both aspects in harmony. Very often some packages with visually attractive designs arrive at the point -of-sale in bad condition because their structural design is defective. Conversely, some packages with excellent structural design may be unattractive to consumers because of poor packaging graphics. When this happens, the image of the product is poor and sales suffer (TIEPIK, 2005).

There are no ideal and universally applicable graphic or structural designs. It is, however, important to note that the success of a design depends, almost exclusively, on how well it meets the demands of the particular target markets concerned. When deciding the appropriate

visual impact for a package, it should be borne in mind that both structural and graphic design can contribute to the achievement of the desired promotional effects.

While graphics communicate the main verbal and pictorial messages, the shape and structure can create impressions of strength or fragility, elegance or practicality, and can be key elements of a brand image. The package should give a valid impression of the product – that is, it should not deceive by looking significantly more or less expensive than its contents. The colours, brand name or the decorative motifs should not offend the target group's tastes, religion or customs in a target market (TIEPIK, 2005).

The appearance and presentation of industrial goods require just as much attention as consumer products. While proper protection and containment of such products must be emphasised in the package planning and selection, it is also important that the goods are easy to handle and that the packaging appears professional, clean and attractive on receipt at its destination.

Functions of Packaging

Basically, the functions of packaging are an important aspect to this study. Many authors have commented generously on the functions of packaging. This section describes the various functions of packaging and how they are being applied in Ghana by the local manufacturers and packaging experts.

Containing the Product

The package should effectively contain a defined quantity of product, using the available pack volume as efficiently as possible. Depending on the nature of the product, the package

may need to be airtight, liquid tight or powder tight, to prevent escape of the product or ingress of contaminating materials. The quantity of product may be measured by volume, by weight or by count. Tight dimensioning, i.e., keeping the pack size to a minimum, is usually important both for economy and to optimize package strength. A tight package, with minimal empty space, normally withstands pressure and handling stresses better than a loosely filled one; the product itself can often contribute to pack strength. A loosely filled package has to bear the stresses alone (TIEPIK, 2005).

Also, an unnecessarily large package means waste of packaging material and extra transport cost. In many countries, environmental and consumer protection organizations criticize packages that are bigger than needed for their contents. Recycling of packaging, mandatory in some countries, is usually charged by weight and according to the type of material; minimal packaging should, therefore, minimize disposal costs. Minimizing package size should not, of course, mean reducing the package specification to a point where the safety and integrity of the product are at risk (TIEPIK, 2005).

Pilditch (1961) sums up the argument on the containment function of packaging in his statement –the package carries the product from factory to end-user, across seas, over hills, through swamps. It guards goods in frozen freight cars or on scorching docks and it delivers them, after weeks of jerks and bumps and abuse, as fresh and crisp as when they left the safe order. Thus, bringing to question the protective role of packaging (Pilditch, 1961).

Packaging must meet all of these challenges as well as contain the product itself. This implies a resistance to both internal and external corrosion, with effective properties that guarantee resistance to gas, oxygen, water and smells. In this explanation, packaging is seen as

performing different functions all at the same time. It is a good package which is able to do all these, and it takes a good graphic designer to design such a package.

Packaging Protects

Pilditch (1961) further emphasises that the primary job of a pack is to protect goods against spoilage, breakage, humidity, shock, vibration, light, odour, bacteria, moisture, climate, pilferage, chemical reaction and physical risks. This view was shared by Smith (2003) as he argued that a pack must protect its contents during storage, transport and usage. However, it must also protect the user from the contents. Children must be protected from weed killers, medicine, chemicals, etc., while protecting the contents from tampering.

Packaging must be able to withstand robust physical handling during distribution so that the goods are received by consumers in the same function they left the factory. Some products require special attention to prevent damage during shipment. Such efforts must be carefully balanced against increased costs that arise (e.g., stronger packaging in order to provide greater protection to products). The product must be protected against attacks from all quarters: heat, dampness, air, bumps suffered during transportation (TIEPIK, 2005). The package must be designed so that the product is kept in perfect condition until it reaches the end user. Thus the motto for packaging:

According to the World Packaging Organisation, a package must be *As strong as is needed, as economical as possible.*

Product Types and Protection Required

It must be noted, however, that products made from different structures need protection from different eventualities. Examples of some products and their most important protection needs are listed below:

Product Type	**Protection Required**
Fresh fruits and vegetables	Bruising
Dried foodstuffs	Moisture, colliding
Textiles and garments	Moisture (moulding), Insects, dust, dirt, Light (discolouration, fading)
Wooden products and lacquerware	Scratching (surface damage), Moisture (moulding), Breakage, Light (discolouration)
Leather products	Moisture (surface staining and moulding) Drying, which results in a loss of flexibility Surface scratching
Stoneware, bone articles, glassware, shells, ceramics	Breakage
Metal products	Moisture (corrosion, tarnishing) Surface scratching, Breakage
Paper products	Moisture, Light
Straw and similar products	Moisture, Crushing
Jewellery products	Loss, theft, Breakage

Table 1.1: What packaging protects products from. (ITO, 2010).

Quite apart from transport package, most goods need inner packaging for basic protection. This protection function of the inner package is determined by the type and quality of the product contained. From the viewpoint of the inner-package protection needed, products can be classified into the following categories:

- Products such as foodstuff which need consumer packaging because of their nature. Package requirements are high for both hygienic and appearance reasons.
- Products which are basically sold to the consumer without the help of the package, such as garments, shoes, textiles and handbags. These goods are usually displayed without a pack in a retail shop. They need a simple package which enables shopkeepers to handle them and which prevents the products from getting dirty or lost.
- Products which may be shown and sold without a package but which need a consumer package to protect them and to prevent parts from getting lost. These include sets of glasses and other tableware, decorative items with fragile parts, glass vases and other breakable products. The requirements for the construction and appearance of such packages are therefore higher, as it is intended for the final consumer.
- Expensive products such and gift items such as jewellery, for which the package has to be of good quality and adapted to the product as regards construction, materials and appearance. For this group of products, the package is an important part of the marketing effort.

  It is worth noting that the more expensive or exclusive the product, the the greater the justification for better and more expensive packaging. In all categories, products sold to the consumer through self-service shops need to be packaged and marked so that

the consumer does not need to open the package to know the content. In addition considering protection needs, there is the need also to take into account the marketing aspects. Many different types of packages and materials- either singly or in various combinations- can be used to give both the required protection and the sales appeal in a cost-effective way.

Packaging Preserves

Packaging must preserve product integrity by protecting the actual product against potential damage from climatic, bacteriological and transit hazards (Stewart, 1995).

Packaging must preserve the product from deterioration and contamination so that the health of the final consumer is not compromised (Hanlon 1971). Stressing on the need of the package to preserve its contents, he stated that for products which might not be used or consumed immediately, it must be protected and preserved for an extended period of time, and this, the packaging must be able to accomplish.

Britannica (1984) shares a similar view by commenting that most of food packaging is designed to protect it from its surrounding and to delay the process of deterioration beyond the time needed for transportation, marketing and consumption.

Packaging Facilitates Distribution and Handling

Effective packaging is key to ensuring that products reach their destination in optimum condition. The package should facilitate safe handling of the product from the time of packing until its usage by the end user. For an exporter, transport and distribution charges are

normally a major part of the total product cost which add to the price of the product without enhancing its value or quality. The package design should therefore contribute as much as possible to minimizing handling costs throughout the distribution chain. Whereas in many developing countries manual handling is cheap and mechanical handling facilities non-existent, in industrialized countries the high costs of manual handling necessitate the use of mechanical aids. Handling requirements also apply to the recycling or disposal of the used packaging. The packaging system should be planned so that all components are easily handled in the distribution chains of target markets, whether mechanized or not (TIEPIK, 2005).

Packaging Promotes Customer Choices

According to Herdeg (1961), with all functional needs met, the well-designed pack is not only aesthetically satisfying but is today essential for the promotion of consumer choices in an increasingly competitive field. Packaging therefore enables and promotes brand identification and competition.

Packaging Informs and Instructs

One very important function of packaging is to inform and instruct. This is the communicative role of packaging. Pilditch (1961) quoting Bernard Bolter, writes: - 'The designer's challenge is to communicate the right message as fast and forcefully as much as possible.' The essential function of packaging is to ensure that the packed product reaches the consumer in the same state it left the factory. We only see a part of the cycle when we open the packet, take out the product and throw away the packaging.

The provision of information to the consumer is the primary function of packaging. The earliest forms of packaging reflected this communicative function. Reading the label on the

packaging should inform consumers about the contents of the product, its ingredients, its recommended preservation and use. Packaging law requires that an increasing number of facts be mentioned. The colourings present in the food must be clearly indicated, and protected brand names oblige manufacturers to ensure that any statements made about the origin and composition of the product is a fact. The instructions for use have also come under the close scrutiny of consumers and their representatives. Packaging represents one of the most important vehicles for communicating the brand message directly to the target consumer (Nancarrow et al.,1998). As the retail environment becomes saturated with competitors vying for consumers' attention, packaging has to work harder than ever if the product is to be noticed above the congestion of competitive products (Milton, 1991). Alongside this challenge, retailers are faced with the realisation that consumers not only differ in how they perceive brands but also in how they relate to these brands (Fournier, 1998; Munizand O'Guinn, 2001).

Consumer Convenience

Civilization and work patterns have created a demand for packages that offer time-saving and conveniently-handled features. This function ties in perfectly with the saying that time is money and so fast foods and canned foods have come in handy for the fast growing working populace. As individuals become very busy in their day to day activities, they resort to things that are easy going. For instance, one can easily heat his meal with a microwave for lunch or dinner , and quickly return to schedule. (TIEPIK 2005).

The Efficiency of Packaging Materials

Over the years, different materials have been used to package things in one form or the other. All over the world, various improvised materials have been used to serve the purpose of

packaging for their items or products. As it has already been identified, packaging materials, come however, from two sources – natural and artificial. The first materials used for packaging were acquired from natural sources. Some of those obtained from natural sources are more or less ready-made or require rudimentary methods to make them. They include animal skins, gourds, shells, hollowed wood, leaves, coconut shell; bamboo and any other thing that can serve similar purposes which nature has endowed that require no scientific processes for conversion ("History of Packaging", 2007).

These natural materials served the purpose of packaging but not to the fullest. Many limitations were discovered as man progressed in life. Problems identified with these natural materials include: uneven sizes or capacity to hold same amount of content, limitation in supply, easy acquisition and unhygienic nature of some of them. There could also be limited opportunity or much difficulty, if not impossible, to brand or decorate some of them with the printing and treatment (sterilization) processes we have today. The quest for more efficient materials for packaging brought about the research into artificial materials. The modern packaging materials and technologies we have today are the result of man's effort at developing efficient packaging.

At present, the basic materials for packaging include paper, paperboard, plastics, glass, wood, cellophane, steel, aluminum and textiles. These materials are processed or fabricated into the various forms of packaging we have today.

To effectively review the packaging materials available today, it is better to categorise them into flexible, semi-flexible, rigid and semi-rigid packaging materials. Some of these may be transparent, translucent or opaque in nature. The materials that fall under the flexible category are: rubber sheets, textiles fabrics, cellophane and some plastics, polyethylene and

foils (Export Packaging, 2007). The semi-flexible/semi-rigid included plastics, paperboards, veneer and micas. Under the rigid category we have steel, iron, silver, copper, wood, and some plastics. Each of all these materials for packaging has different properties, so they are processed using different technologies. They also have different advantages and disadvantages over each other. The suitability of each depends on what product it is to contain and the purpose it is to serve.

The Nature of Packaging

From the history and development of packaging we can realise that the term packaging is complex, as it can be put into a different contexts. Packaging has so many forms as different materials and purposes influence it. It is imperative at this point to look at what kind of packaging is under review and how some people with requisite knowledge about packaging have described it. Hanlon (1971) opens the studies on the nature of packaging by looking at its familiar form as the box on the grocer's shelf and the wrapper on a candy bar or the crate around a machine or a bulk container for chemicals. He further explained it in a broader sense as any structure that contains or limits its contents such as crates, nests, cocoons as well as displays, utensils and conveyances.

Leonard (1980) as quoted by Ockumpah-Bortei (1991) indicated that "A package consists of both structure and appearance". Thus, a package can be looked at in two different ways: The structural design, that is, the construction of package from the technical point of view, which is what this project is about, and the visual design, that is the appearance of the package and its promotional value. Ockumpah-Bortei (1991) explained that these two aspects may be distinct but inseparable.

Ockumpah-Bortei (1991) made some observations on this statement and categorised it into three main parts: consumer packaging, industrial packaging and military packaging. This means there are different approaches to consumer packaging, industrial packaging and military packaging.

What goes into consumer packaging for both export and the local market also holds for the consumer products packaging. The author, comparing the views of the two authors, observed that though they seem to agree, but their interpretations differ in context. Leonard's statement is applicable to all forms of packaging; for every package has a form and appearance which can be beautiful or ugly. The author is of the view that Ockumpah's interpretations can only be applied to only manufactured packages which the manufacturer and the client have some control over or can pre-determine its appearance for promotional purposes. Again, it is not every package that is meant to promote sales. It could only be as a wrap for transporting the product, for temporal storage of product in the warehouse or just for transporting the goods to a different location.

Ariev (2006) observed that "Virtually all manufactured and processed goods require packaging during some phase of their production and distribution". The statement "….during some phase of their production" indicates that some packages are not for promotion or for marketing, but to help in the production of other products. The statement also buttresses the need for packaging in production and distribution of goods. During production of some commodities especially alcoholic beverages, some of the ingredients must be stored in vats for some time for fermentation to take place before the alcohol can be produced. So packaging is very vital to modern production and distribution processes.

Materials used in making Packaging Structures

Ghana's packaging sector is dominated by small-scale enterprises which are mostlySeveral materials may be used as packaging structures. The commons ones, however, include paper, plastic, wood, metal, shrink wrap, fabric and glass, among others. Mention must be made here that these materials should be able to prevent spoilage, withstand stress and allow proper marking (Hollins & Pugh, 1990). In using these materials, environmental concerns must be considered, to the effect that as much as possible, biodegradable materials should be used. The cost and quality of the materials used must be considered in selecting the materials.

Glass

Glass has an extremely long history in food packaging; the first glass objects for holding food are believed to have appeared around 3000 BC (Sacharow & Griffin 1980). The production of glass containers involves heating a mixture of silica (the glass former), sodium carbonate (the melting agent), and limestone/calcium carbonate and alumina (stabilizer) to high temperatures until the materials melt into a thick liquid mass that is then poured into moulds. Recycled broken glass (cullet) is also used in glass manufacture and may account for as much as 60% of all raw materials. Glass containers used in food packaging are often surface-coated to provide lubrication in the production line and eliminate scratching or surface abrasion and line jams. Glass coatings also increase and preserve the strength of the bottle to reduce breakage. Improved break resistors help manufacturers to use thinner glass which reduces weights and is better for disposal and transportation (McKown 2000). Because it is odorless and chemically inert with virtually all food products, glass has several advantages for food-packaging applications; it is impermeable to gases and vapours, so it maintains product freshness for a long period of time without impairing taste or flavour. The ability to withstand high processing temperatures makes glass useful for heat sterilization of both low-acid foods.

Glass is rigid, provides good insulation, and can be produced in numerous shapes. The transparency of glass allows consumers to see the product, yet variations in glass colour can protect light-sensitive contents. Finally, glass packaging benefits the environment because it is reusable and recyclable. Like any material, glass has some disadvantages. Despite efforts to use thinner glass, its heavy weight adds to transportation costs. Another concern is its brittleness and susceptibility to breakage from internal pressure, impact or thermal shock. Ghana used to produce glass packages at the Aboso Glass factory. Currently, all glass packages are imported.

Metal

Metal is the most versatile of all packaging forms. It offers a combination of excellent physical protection and barrier properties, formability and decorative potentials, recyclability, and consumer acceptance. The two metals most predominantly used in packaging are aluminium and steel.

Aluminum

Commonly used to make cans, foil, and laminated paper or plastic packaging, aluminum is a light weight, silvery white metal derived from bauxite ore, where it exists in combination with oxygen and alumina. Magnesium and manganese are often added to alumina to improve its strength properties (Page et al 2003). Unlike many metals, aluminium is highly resistant to most forms of corrosion; its natural coating of aluminum oxide provides a highly effective barrier to the effects of air, temperature, moisture, and chemical attack. Besides providing an excellent barrier to moisture, air, odours, light, and microorganisms, aluminum has good flexibility and surface resilience, excellent malleability and formability, and outstanding embossing potential. It is also an ideal material for recycling because it is to reclaim and

process into new products. Pure aluminum is used for light packaging of primarily soft-drink cans, pet food, seafood, and prethreaded closures. The main disadvantages of aluminum are its high cost compared to other metals (for example, steel) and its inability to be welded, which makes it useful only for making seamless containers.

Aluminum foil

Aluminum foil is made by rolling pure aluminum metal into very thin sheets, followed by annealing to achieve dead-folding properties (a crease or fold made in the film will stay in place), which allows it to be folded tightly. Moreover, aluminum foil is available in a wide range of thickness, with thinner foils used to wrap food and thicker foils used for trays. Like all aluminum packaging, foil provides an excellent barrier to moisture, air, odour, light, and microorganisms. It is inert to acidic foods and does not require lacquer or other protection. Although aluminum is easily recyclable, foils cannot be made from recycled aluminum without pinhole formation in the thin sheets.

Laminates and metallized films

Lamination of packaging involves the binding of aluminum foil to paper or plastic film to improve barrier properties. Thin gauges facilitate application. Although lamination to plastic enables heat sealability, the seal does not completely bar moisture and air. Because laminated aluminum is relatively expensive, it is typically used to package high value foods such as dried soup, herbs, and spices. A less expensive alternative to laminated packaging is metallized film. Metallized films are plastics containing a thin layer of aluminum metal (Fellow & Axtell 2002). These films have improved barrier properties to moisture, oils, air, and odors, and the highly reflective surface of the aluminum is attractive to consumers. More flexible than laminated films, metallized films are mainly used to package snacks. Although

the individual components of laminates and metallized films are technically recyclable, the difficulty in sorting and separating the material precludes economically feasible recycling.

Tinplate

Produced from low-carbon steel (that is, black plate), tinplate is the result of coating both sides of blackplate with thin layers of tin. The coating is achieved by dipping sheets of steel in molten tin (hot-dipped tinplate) or by the electro-deposition of tin on the steel sheet (electrolytic tinplate). Although tin provides steel with some corrosion resistance, tinplate containers are often lacquered to provide an inert barrier between the metal and the food product. Commonly used lacquers are materials in the epoxy phenolic and oleoresinous groups and vinyl resins. In addition to its excellent barrier properties to gases, water vapor, light, and odors, tinplate can be heat-treated and sealed hermetically, making it suitable for sterile products. Because it has good ductility and formability, tinplate can be used for containers of many different shapes. Thus, tinplate is widely used to form cans for drinks, processed foods, and aerosols; containers for powdered foods and sugar- or flour-based confections; and as package closures. Tinplate is an excellent substrate for modern metal coating and litho

printing technology, enabling outstanding graphical decoration. Its relatively low weight and high mechanical strength make it easy to ship and store. Finally, tinplate is easily recycled many times without loss of quality and is significantly lower in cost than aluminum.

Tin-free steel

Also known as electrolytic chromium or chrome oxide coated steel, tin-free steel requires a coating of organic material to provide complete corrosion resistance. Even though the chrome/chrome oxide makes tin-free steel unsuitable for welding, this property makes it

excellent for adhesion of coatings such as paints, lacquers, and inks. Like tinplate, tin-free steel has good formability and strength, but it is marginally less expensive than tinplate. Food cans, can ends, trays, bottle caps, and closures can all be made from tin-free steel. In addition, it can also be used to make large containers (such as drums) for bulk sale and bulk storage of ingredients or finished goods (Fellows & Axtell 2002).

Plastics

Plastics are made by condensation polymerization (polycondensation) or addition polymerization (polyaddition) of monomer units. In polycondensation, the polymer chain grows by condensation reactions between molecules and is accompanied by formation of low molecular weight byproducts such as water and methanol. Polycondensation involves monomers with at least 2 functional groups such as alcohol, amine, or carboxylic groups. In polyaddition, polymer chains grow by addition reactions, in which 2 or more molecules combine to form a larger molecule without liberation of by-products. Polyaddition involves unsaturated monomers; double or triple bonds are broken to link monomer chains. There are several advantages to using plastics for food packaging. Fluid and moldable, plastics can be made into sheets, shapes, and structures, offering considerable design flexibility. Because they are chemically resistant, plastics are inexpensive and lightweight with a wide range of physical and optical properties. In fact, many plastics are heat sealable, easy to print, and can be integrated into production processes where the package is formed, filled, and sealed in the same production line. The major disadvantage of plastics is their variable permeability to light, gases, vapors, and low molecular weight molecules.

In Ghana, it is estimated that there are over forty (40) plastic manufacturing companies, producing over 31,000 metric tons of assorted plastic products per annum. In addition, about 12,000 metric tons of finished plastic products are imported annually into the country. 90% of

the plastic manufacturing companies are located in the Accra-Tema metropolis (Fobil J.N. 2000).

Types of Plastics

There are 2 major categories of plastics: thermosets and thermoplastics (EPA 2006b). Thermosets are polymers that solidify or set irreversibly when heated and cannot be remolded. Because they are strong and durable, they tend to be used primarily in automobiles and construction applications such as adhesives and coatings, not in food packaging applications. On the other hand, thermoplastics are polymers that soften upon exposure to heat and return to their original condition at room temperature. Because thermoplastics can easily be shaped and molded into various products such as bottles, jugs, and plastic films, they are ideal for food packaging. Moreover, virtually all thermoplastics are recyclable (melted and reused as raw materials for production of new products), although separation poses some practical limitations for certain products. The recycling process requires separation by resin. There have been some health concerns regarding residual monomer and components in plastics, including stabilizers, plasticizers, and condensation components such as bisphenol. Some of these concerns are based on studies using very high intake levels; others have no scientific basis. To ensure public safety, there is the need to carefully review and regulate substances used to make plastics and other packaging materials. Any substance that can reasonably be expected to migrate into food is classified as an indirect food additive. Consumers are therefore advised to use plastics for intended purposes in accordance with the manufacturer's directions to avoid unintentional safety concerns.

Despite these safety concerns, the use of plastics in food packaging has continued to increase due to the low cost of materials and functional advantages (such as thermosealability, microwavability, optical properties, and unlimited sizes and shapes) over traditional materials

such as glass and tinplate (Lopez-Rubio et al 2004). Multiple types of plastics are being used as materials for packaging food, including polyolefin, polyester, polyvinyl chloride, polyvinylidene chloride, polystyrene, polyamide, and ethylene vinyl alcohol. Although more than 30 types of plastics have been used as packaging materials (Lau & Wong 2000), polyolefins and polyesters are the most common.

Polyolefins

Polyolefin is a collective term for polyethylene and polypropylene, the 2 most widely used plastics in food packaging, and other less popular olefin polymers. Polyethylene and polypropylene both possess a successful combination of properties, including flexibility, strength, lightness, stability, moisture and chemical resistance, and easy processability, and are well suited for recycling and reuse.

The simplest and most inexpensive plastic made by addition polymerization of ethylene is polyethylene. There are 2 basic categories of polyethylene: high density and low density. High-density polyethylene is stiff, strong, tough, resistant to chemicals and moisture, permeable to gas, easy to process, and easy to form. It is used to make bottles for milk, juice, and water; cereal box liners; margarine tubs; and grocery, trash, and retail bags. Low-density polyethylene is flexible, strong, tough, easy to seal, and resistant to moisture. Because low-density polyethylene is relatively transparent, it is predominately used in film applications and in applications where heat sealing is necessary. Bread and frozen food bags, flexible lids, and squeezable food bottles are examples of low-density polyethylene. Polyethylene bags are sometimes reused (both for grocery and nongrocery retail). Of the 2 categories of polyethylene, high-density polyethylene containers, especially milk bottles, are the most recycled among plastic packages.

Harder, denser, and more transparent than polyethylene, polypropylene has good resistance to chemicals and is effective at barring water vapor. Its high melting point (160 °C) makes it suitable for applications where thermal resistance is required, such as hot-filled and microwavable packaging. Popular uses include yogurt containers and margarine tubs. When used in combination with an oxygen barrier such as ethylene vinyl alcohol or polyvinylidene chloride, polypropylene provides the strength and moisture barrier for catsup and salad dressing bottles.

Polyesters

Polyethylene terephthalate (PET or PETE), polycarbonate, and polyethylene naphthalate (PEN) are polyesters, which are condensation polymers formed from ester monomers that result from the reaction between carboxylic acid and alcohol. The most commonly used polyester in food packaging is PETE.

Polyethylene terephthalate

Formed when terephthalic acid reacts with ethylene glycol, PETE provides a good barrier to gases (oxygen and carbon dioxide) and moisture. It also has good resistance to heat, mineral oils, solvents, and acids, but not to bases. Consequently, PETE is becoming the packaging material of choice for many food products, particularly beverages and mineral waters. The use of PETE to make plastic bottles for carbonated drinks is increasing steadily (van Willige and others 2002). The main reasons for its popularity are its glass-like transparency, adequate gas barrier for retention of carbonation, light weight, and shatter resistance.

The 3 major packaging applications of PETE are containers (bottles, jars, and tubs), semi-rigid sheets for thermoforming (trays and blisters), and thin-oriented films (bags and snack food wrappers). PETE exists both as an amorphous (transparent) and a semicrystalline

(opaque and white) thermoplastic material. Amorphous PETE has better ductility but less stiffness and hardness than semicrystalline PETE, which has good strength, ductility, stiffness, and hardness. Recycled PETE from soda bottles is used as fibers, insulation, and other nonfood packaging applications.

Polycarbonate

Polycarbonate is formed by polymerization of a sodium salt of bisphenol acid with carbonyl dichloride (phosgene). Clear, heat resistant, and durable, it is mainly used as a replacement for glass in items such as large returnable/refillable water bottles and sterilizable baby bottles. Care must be taken when cleaning polycarbonate because using harsh detergents such as sodium hypochlorite is not recommended because they catalyze the release of bisphenol A, a potential health hazard. An extensive literature analysis by vomSaal & Hughes (2005) suggests the need for a new risk assessment for the low-dose effects of this compound.

Polyethylene naphthalate

PEN is a condensation polymer of dimethyl naphthalene dicarboxylate and ethylene glycol. It is a relatively new member of the polyester family with excellent performance because of its high glass transition temperature. PEN's barrier properties for carbon dioxide, oxygen, and water vapor are superior to those of PETE, and PEN provides better performance at high temperatures, allowing hot refills, rewashing, and reuse. However, PEN costs 3 to 4 times more than PETE. Because PEN provides protection against transfer of flavours and odours, it is well suited for manufacturing bottles for beverages such as beer.

Polyvinyl chloride

Polyvinyl chloride (PVC), an addition polymer of vinyl chloride, is heavy, stiff, ductile, and a medium strong, amorphous, transparent material. It has excellent resistance to chemicals (acids and bases), grease, and oil; good flow characteristics; and stable electrical properties. Although PVC is primarily used in medical and other nonfood applications, its food uses include bottles and packaging films. Because it is easily thermoformed, PVC sheets are widely used for blister packs such as those for meat products and unit dose pharmaceutical packaging.

PVC can be transformed into materials with a wide range of flexibility with the addition of plasticizers such as phthalates, adipates, citrates, and phosphates. Phthalates are mainly used in nonfood packaging applications such as cosmetics, toys, and medical devices. Safety concerns have emerged over the use of phthalates in certain products, such as toys (Shea 2003; European Union 2005). Because of these safety concerns, phthalates are not used in food packaging materials in the United States (HHS 2005); instead, alternative nonphthalate plasticizers such as adipates are used. Finally, PVC is difficult to recycle because it is used for such a variety of products, which makes it difficult to identify and separate. In addition, incineration of PVC presents environmental problems because of its chlorine content.

Polyvinylidene chloride

Polyvinylidene chloride (PVdC) is an addition polymer of vinylidene chloride. It is heat sealable and serves as an excellent barrier to water vapor, gases, and fatty and oily products. It is used in flexible packaging as a monolayer film, a coating, or part of a co-extruded product. Major applications include packaging of poultry, cured meats, cheese, snack foods, tea, coffee, and confectionary. It is also used in hot filling, retorting, low-temperature storage,

and modified atmosphere packaging. PVdC contains twice the amount of chlorine as PVC and therefore also presents problems with incineration.

Polystyrene

Polystyrene, an addition polymer of styrene, is clear, hard, and brittle with a relatively low melting point. It can be mono-extruded, co-extruded with other plastics, injection molded, or foamed to produce a range of products. Foaming produces an opaque, rigid, lightweight material with impact protection and thermal insulation properties. Typical applications include protective packaging such as egg cartons, containers, disposable plastic silverware, lids, cups, plates, bottles, and food trays. In expanded form, polystyrene is used for nonfood packaging and cushioning, and it can be recycled or incinerated.

Polyamide

Commonly known as nylon (a brand name for a range of products produced by DuPont), polyamides were originally used in textiles. Formed by a condensation reaction between diamine and diacid, polyamides are polymers in which the repeating units are held together by amide links. Different types of polyamides are characterized by a number that relates to the number of carbons in the originating monomer. For example, nylon-6 has 6 carbons and is typically used in packaging. It has mechanical and thermal properties similar to PETE, so it has similar usefulness, such as boil-in bag packaging. Nylon also offers good chemical resistance, toughness, and low gas permeability.

Ethylene vinyl alcohol

Ethylene vinyl alcohol (EVOH) is a copolymer of ethylene and vinyl alcohol. It is an excellent barrier to oil, fat, and oxygen. However, EVOH is moisture sensitive and is thus

mostly used in multilayered co-extruded films in situation where it is not in direct contact with liquids.

Laminates and co-extrusions

Plastic materials can be manufactured either as a single film or as a combination of more than 1 plastic. There are 2 ways of combining plastics: lamination and co-extrusion. Lamination involves bonding together 2 or more plastics or bonding plastic to another material such as paper or aluminum. Bonding is commonly achieved by use of water-, solvent-, or solids-based adhesives. After the adhesives are applied to 1 film, 2 films are passed between rollers to pressure bond them together. Lamination using laser rather than adhesives has also been used for thermoplastics (Kirwan & Strawbridge 2003). Lamination enables reverse printing, in which the printing is buried between layers and thus not subject to abrasion, and can add or enhance heat sealability.

In co-extrusion, 2 or more layers of molten plastics are combined during the film manufacture. This process is more rapid (requires 1 step in comparison to multiple steps with lamination) but requires materials that have thermal characteristics that allow co-extrusion. Because co-extrusion and lamination combine multiple materials, recycling is complicated. However, combining materials results in the additive advantage of properties from each individual material and often reduces the total amount of packaging material required. Therefore, co-extrusion and lamination can be sources of packaging reduction.

Paper and paperboard

The use of paper and paperboards for food packaging dates back to the 17th century with accelerated usage in the later part of the 19th century (Kirwan 2003). Paper and paperboard are sheet materials made from an interlaced network of cellulose fibers derived from wood by

using sulfate and sulfite. The fibres are then pulped and/or bleached and treated with chemicals such as slimicides and strengthening agents to produce the paper product. Paper and paperboards are commonly used in corrugated boxes, milk cartons, folding cartons, bags and sacks, and wrapping paper. Tissue paper, paper plates, and cups are other examples of paper and paperboard products.

Paper

Plain paper is not used to protect foods for long periods of time because it has poor barrier properties and is not heat sealable. It is a material with a weight of less than 225gsm (grams per square metre).When used as primary packaging (that is, in contact with food), paper is almost always treated, coated, laminated, or impregnated with materials such as waxes, resins, or lacquers to improve functional and protective properties. The many different types of paper used in food packaging are as follows:

• **Kraft paper** - Produced by a sulfate treatment process, kraft paper is available in several forms: natural brown, unbleached, heavy duty, and bleached white. The natural kraft is the strongest of all paper and is commonly used for bags and wrapping. It is also used to package flour, sugar, and dried fruits and vegetables.

• **Sulfite paper** - Lighter and weaker than kraft paper, sulfite paper is glazed to improve its appearance and to increase its wet strength and oil resistance. It can be coated for higher print quality and is also used in laminates with plastic or foil. It is used to make small bags or wrappers for packaging biscuits and confectionary.

• **Greaseproof paper** - Greaseproof paper is made through a process known as beating, in which the cellulose fibers undergo a longer than normal hydration period that causes the fibers to break up and become gelatinous. These fine fibres then pack densely to provide a

surface that is resistant to oils but not wet agents. Greaseproof paper is used to wrap snack foods, cookies, candy bars, and other oily foods, a use that is being replaced by plastic films.

• **Glassine** - Glassine is greaseproof paper taken to an extreme (further hydration) to produce a very dense sheet with a highly smooth and glossy finish. It is used as a liner for biscuits, cooking fats, fast foods, and baked goods.

• **Parchment paper** - Parchment paper is made from acid-treated pulp (passed through a sulfuric acid bath). The acid modifies the cellulose to make it smoother and impervious to water and oil, which adds some wet strength. It does not provide a good barrier to air and moisture, is not heat sealable, and is used to package fats such as butter and lard.

Paperboard

Paperboard is thicker than normal paper with a higher weight per unit area and often made in multiple layers, with a weight of more than 225gsm. It is commonly used to make containers for shipping—such as boxes, cartons, and trays—and seldom used for direct food contact. The various types of paperboard are as follows (Soroka 1999):

• **White board** - Made from several thin layers of bleached chemical pulp, white board is typically used as the inner layer of a carton. White board may be coated with wax or laminated with polyethylene for heat sealability, and it is the only form of paperboard recommended for direct food contact.

• **Solid board** - Possessing strength and durability, solid board has multiple layers of bleached sulfate board. When laminated with polyethylene, it is used to create liquid cartons (known as milk board). Solid board is also used to package fruit juices and soft drinks.

• **Cardboard** - It is a material with a weight between 150 and 600 gsm. It is more rigid than paper and often coated.

• **Corrugated board** - Fluted paper glued onto or between paper or board. The most common ones are:

Single face: One layer of fluted paper glued to one layer of paper or board

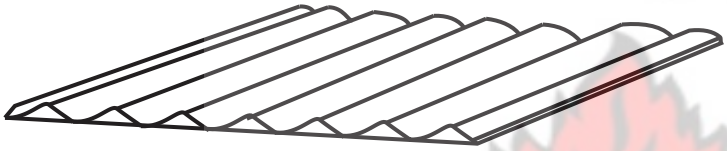


Figure 2.1: Single face corrugated board

Double face or Single wall: One layer of fluted paper glued to two layers of paper or board

Figure 2.2: Double face corrugated board

Double wall: Two layers of fluted paper glued to three layers of paper or board

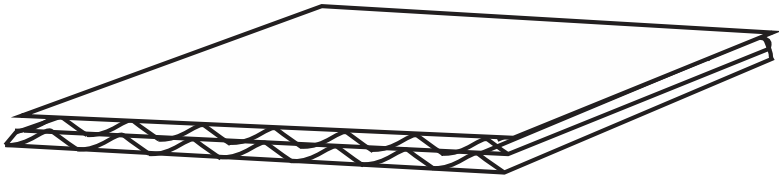


Figure 2.3: Double wall corrugated board

Triple wall: Three layers of fluted paper glued to four layers of paper or board

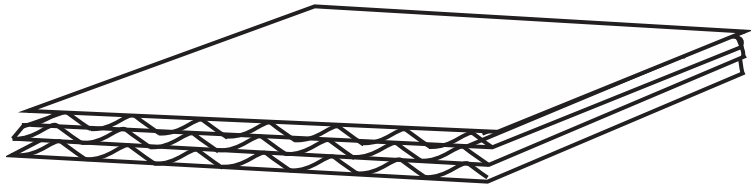


Figure 2.4: Triple wall corrugated board

In addition to the materials and number of layers, corrugated board is defined by the type of flute. Flute type is generally designated using a letter code and is determined by the number pf flutes per linear metre (or foot) and the flute thickness. (Pepin, 2010).

• **Chipboard -** Chipboard is made from recycled paper and often contains blemishes and impurities from the original paper, which makes it unsuitable for direct contact with food, printing, and folding. It is often lined with white board to improve both appearance and strength. The least expensive form of paperboard, chipboard is used to make the outer layers of cartons for foods such as tea and cereals.

• **Fiberboard**—Fiberboard can be solid or corrugated. The solid type has an inner white board layer and outer kraft layer and provides good protection against impact and compression. When laminated with plastics or aluminum, solid fiberboard can improve barrier properties and is used to package dry products such as coffee and milk powder. The corrugated type, also known as corrugated board, is made with 2 layers of kraft paper with a central corrugating (or fluting) material. Fiberboard's resistance to impact abrasion and crushing damage makes it widely used for shipping bulk food and case packing of retail food products.

Paper laminates

Paper laminates are coated or uncoated papers based on kraft and sulfite pulp. They can be laminated with plastic or aluminum to improve various properties. For example, paper can be laminated with polyethylene to make it heat sealable and to improve gas and moisture barrier properties. However, lamination substantially increases the cost of paper. Laminated paper is used to package dried products such as soups, herbs, and spices.

Packaging Materials used in Ghana

Government's policy on import substitution in the 1950s led to the establishment of industries for the manufacture of canned foods, alcoholic and non-alcoholic beverages and household equipment resulting in the development of a complementary packaging sector. Ghana's packaging sector is dominated by small-scale enterprises which are mostly involved in the production of plastic and paper and paper board and printing. Plastic packaging and printing are the fastest growing subsectors in the industry with a majority of small and medium scale enterprises engaged in this venture. The distribution of the various types of packaging in the domestic market are: plastic packaging 40%, paper packaging 25%, metal packaging 15%, glas packaging 10%, wooden crates and pallet packaging 5%, jute and cotton fabric 5%. Situational Analysis, Jan, 2014)

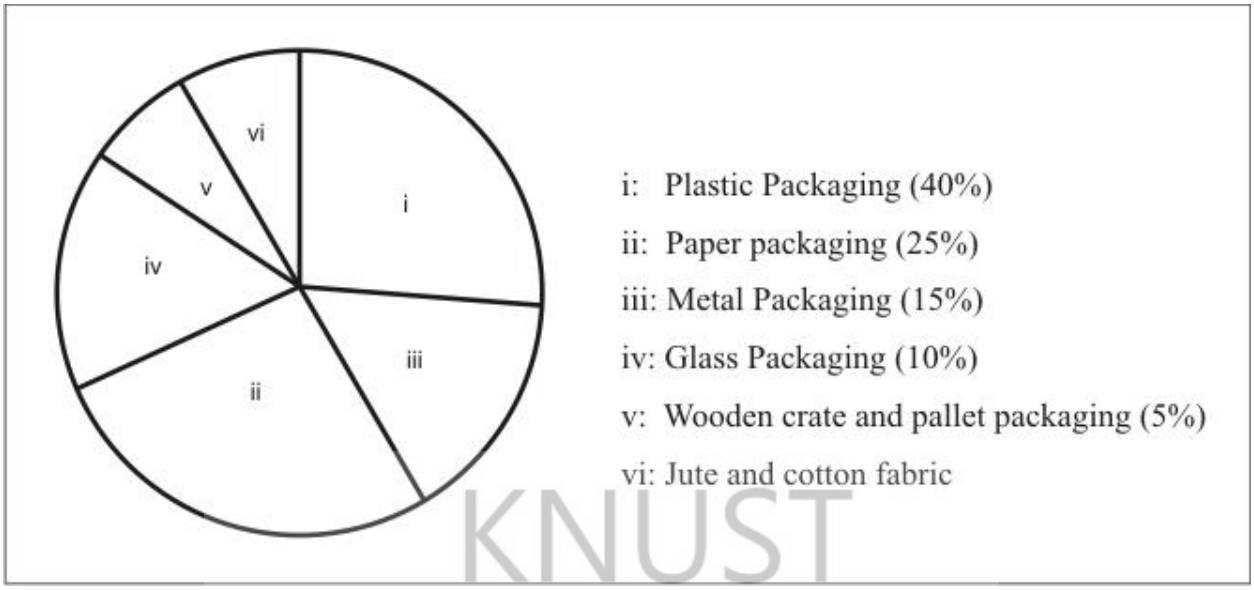


Figure 2.5: The distribution of packaging materials on Ghana's domestic market (Source: IOPG, Situational Analysis, Jan, 2014)

Production Standards on Structural Packaging

According to International Code For Good Manufacturing Practices 2011, all manufacturers shall comply to laid down regulations in their respective countries and ensure that

- materials and articles do not endanger human health
- unacceptable change in the composition of the package are prevented
- there shall be no deterioration in the organoleptic properties in, for example, food packages.
- they meet the requirements for trans-border migration
- their packages are Fit-For-Use in accordance with its foreseeable applications and meet the required performance
- their materials meet the essential requirements regarding the Packaging and Packaging Waste Directives.

Manufacturers must comply with legislation or official standards that cover the objectives of Good Manufacturing Practices (GMP), and where these are incomplete or lacking, conformity with the best available guidelines and recommendations that fill the gaps.

Designing the packaging material for compliance' means that the combination of:

• the choice of substrates

• the choice of other raw materials

• the composition of laminates

• the application of inks, adhesives, varnishes and other coatings

• the choice of the production techniques

• and the geometrical design (e.g. surface/volume ratio especially for infant foods)

will be such that protection against migration, organoleptic changes and contamination and compliance with the essential requirements are, as it were, 'built into' the finished product.

Materials testing

Materials and components are often evaluated on a universal testing machine.

The basis of packaging design and performance is the component materials. The physical properties, and sometimes chemical properties, of the materials need to be communicated to packaging engineers to aid in the design process. Suppliers publish data sheets and other technical communications that include the typical or average relevant physical properties and the test method these are based upon. Sometimes these are adequate. Other times, additional material and component testing is required by the packager or supplier to better define certain characteristics.

When a final package design is complete, the specifications for the component materials needs to be communicated to suppliers. Packaging materials testing is often needed to identify the critical material characteristics and engineering tolerances. These are used to prepare and enforce specifications.

For example, shrink film data might include: tensile strength (MD and CD), elongation, Elastic modulus, surface energy, thickness, Moisture vapor transmission rate, Oxygen transmission rate, heat seal strength, heat sealing conditions, heat shrinking conditions, etc. Average and process capability are often provided. The chemical properties related for use as Food contact materials may be necessary.

Labelling

Structures are labelled to provide the consumer vital information about the product. A label is defined as any identified material attached to a product to give information about the product and or to embellish the package for marketing ("Labels", 1997). The information carried by a label may be only textual or in addition bear a company logo, illustrations and photographs. The label, as current local and international regulations demand, should indicate the content, nature, manufacturing and expiry dates, ownership, direction of use, and place of origin on the object it has been affixed to or inserted in (Ghana Standards Board General Labelling Rules, 1992). The application of labelling in packaging is no more based on the choice of the manufacturer as it used to be but now a mandatory requirement backed by both local and international legislation. As a mandatory requirement, the label design and application in packaging must be carefully done according to the rules, to pave way for a product in both local and international markets and appeals to a targeted market.

Ideally for a consumer, the right label is simple and familiar, possibly uses adjectives or images, does not use technical terms, or specific vocabulary. The quality and quantity of information on products‘ packaging may not suit every consumer's palate, but the general direction is that information displayed should be easily understood for an average consumer and it should help the choice of food (Byrd-Bredbenner, Wong, Cottee, 2000). According to an organisation specialising in environmental labels the basic principles of a good label are: easy to understand, low information cost, voluntary certifications, authenticity, scientific background, abolishing unnecessary commercial barriers, an entire life cycle attitude, support for innovation, keeping administration to the minimum and open discussions looking to agree (GEN, 2004).

The Role of Labelling in Marketing Packages

Labelling is the art of applying or attaching a label to a particular surface, item, or product, ("Labels", 1997). The label does not only serve as a source of product information but can also serve as an advertising piece ("Labels", 1997). Various labels are specially designed and printed to embellish the container or the pack on which they are fixed so that they can appeal to the targeted customers.

Labels have been used as identifiers for some products that have similar packages on the market ("Customer Satisfaction" 1995). Acting as an identifier and distinguishing brands the labelling facilitates the use of one common package design for different products from the same manufacturer or different manufacturers. A label with powerful features in its design would distinguish the product better and attract shoppers' attention much better than a dull one. Buttressing this claim, a Financial Times article: "Customer Satisfaction" (1995), suggests that effective labelling would help consumers to choose "between rows and rows of

almost identical products". Nancarrow et al (1998) also opined that "Effective labelling on the packaging would underpin the main forms of marketing communications of advertising, personal selling, publicity, public relations, direct marketing and sponsorships", to emphasize the various areas under labelling marketing functions. The author deduced that a product label is its identifier and that any major changes done on a label will have an influence on the customers.

Local and International Labelling of Structures

Rules for Product label, nowadays, is supposed to be a useful source of information, primarily to inform and or to protect consumers of the product it identifies. For this reason modern labelling legislation demands specific information to be provided the consumer by product manufacturers and importers. (General Labelling Rules, 1992). The International Standards Organisation (ISO) is the body mandated to set standards for the international market from which a member country can modify to suit their country needs. Labelling regulations are not static but keep changing to meet current labelling demands prevailing in a local or international market.

In reference to this, labelling rules vary from country to country, making it important that the manufacturer or the exporter consult the official trade office of the target market for that country's labelling specifics. Inadequate information on these labelling and other packaging regulations in different markets creates marketing problems for exported goods from most third world countries as observed by Judd et al (1989). Inferring from this observation, it is clear that a potential product in a well decorated or attractive package may not be allowed for sale if the label does not meet the requirements of the country in which it is to be sold. In other words improper labelling can create a trade barrier to a product in both the local as well as the international market. In Ghana the Food and Drugs Authority (FDA) is responsible for

food and drugs packaging and labelling. The Food and Drugs Authority emerged from the Food and Drugs Law 1992, PNDCL 305B which was enacted to control the manufacture, importation, exportation, distribution, use and advertisement of food, drugs, cosmetics, chemical substances and medical devices. They act in both advisory and enforcing capacities in matters related to food and drugs packaging and marketing in collaboration with from the Ghana Standards Authority (GSA). The Legislative Instrument, L.I. 1541, 1992 spells out the Ghana Standards Authority (Food, Drugs and other Goods) General Labelling Rules, 1992. The reference document on Ghana Standards for labelling is GS 45, which was prepared by the Ghana Standards Authority (GSA). The current task of institutions concerned with labelling is to help make sure that manufacturers give consumers the right information they need about their products in an understandable form, as part of the packaging.

Types of Labels and Materials for Structures and their Surface Qualities

Materials on which labels are printed include paper, laminates, metallic foils, plastics, fabrics, leather and synthetic substrates ("Labels", 1997). Some label materials may have adhesive back and other non-adhesive. In all, label materials may be coated or uncoated, pressure-sensitive or heat-sensitive, conventional gummed or particle gummed ("Labels", 1997).

The most commonly used label material worldwide is non-adhesive plain paper type which was originally used on products (Labels, 1997). In recent times self-adhesive labels are picking up and new breed of labelling such as shrink-labelling, in-mould and heat transfer labels have been introduced. The use of shrink-labels and sleeves are becoming more and more popular in the beverage industry ("Printing products- Shrink labels, 2006). In-mould labelling is popular in the plastic packaging (Labels, 1997). In Ghana, the author observed that plain paper non-adhesive labels are cheaper and mostly used by the small-scale private

enterprises. Products from the multinational companies and imported packaged products mostly have high quality adhesive labels on them. Labels may be applied manually or automatically by using electronic label applicators along the packaging line (Labels, 1997). The placement and how well the label is fixed to the surface are very important as they can mar the beauty of it and may also flout a labelling regulation. Hence, label application stage must be considered a critical point where quality measures must not be compromised to create financial losses and bad reputation for the company.

Inks used in Printing on Packaging Structures

Printing inks are used to decorate the exterior of virtually every package and substrate used in packaging. Since there are various substrates, a number of different printing methods are required to satisfy the needs of this entire market. It is the ink that makes the information and images visible on the structure. For a packaging material to be decorated with colour and or to carry textual and images, the printing ink is a sine qua non. Millions of tonnes of inks are manufactured every year for many different printing purposes. About 250 manufacturers produce the bulk of ink used worldwide (Karsnitz, 1997). Inks are produced from over 5000 different ingredients from both natural and synthetic raw material sources. The natural raw materials for ink which are considered environmentally friendly constitute 20% whilst the remaining 80% come from the petro-chemical industry. There are general purpose inks formulated to print on many substrates, whilst there are also special inks formulated for specific kinds of substrates. Special effects inks are also available for elegant-looking prints (Karsnitz, 1997). In spite of the differences in ink formulations the principal ingredients are pigments, vehicles, (solvents) and additives ("Printing and Packaging", 2005). Pigments give inks their colours and they have characteristics such as opacity, permanence, and bleed. Organic colour pigments form the largest group of pigments used in ink production. The

inorganic colour pigments are mainly from minerals such as lead compounds chromium, cadmium, and iron compounds. Aluminium ore is grounded into powder and used as pigment for silver colour ink, grounded brass and copper ores are used as pigments for gold colour inks. Vehicles are resinous materials for binding the pigment particles and also for adhering them to the substrate. Additives are added to give inks more characteristics. They act as catalysts to speed up the ink drying rate. Some are added to soften the ink to reduce tack, to quickly set the ink to reduce set-off in the delivery tray and to improve scuff resistance. Other additives such as body gums and binding varnishes are added to soft inks to increase their viscosity and tack and also to prevent chalking problems. (Advanced Packaging, 2010).

The Structures of Inks

Based on inks drying methods and the structures used, inks can be categorized into four man types: varnish or oil-based inks, hot (heat) set inks, liquid, water-based emulsion inks, and Intermediate consistency inks –also referred to as Printing pastes (Karsnitz, 1997).

The available printing methods can also be used to distinguish inks based on the specific ink type required by each of them. Letterpress inks are oil or varnish-based inks, viscous and tacky, and dry by oxidation. Lithographic inks are oil-based inks with high concentration of pigment. High concentration of pigment is required because of the thin film of ink deposits they lay on substrate. Sheet–fed offset inks are quick-set type with hard resins which gives it high gloss finish. Web-fed offset uses low viscosity and tack inks. They could be heat-set or non heat-set inks. Flexography inks are low-viscous and volatile liquid inks which dry by evaporation used for printing on nonporous substrates. For absorbent paper such as Kraft paper, water-based inks are used. Gravure inks are low viscous liquid inks which dry mostly

by oxidation method. Screen printing inks are intermediate consistency inks (paste ink) even though some other ink types can be used in screen printing. (ITO Journal, 2009).

Safe use of Ink for Packaging

Some of the mineral constituents of inks are known to have harmful effects on humans and the environment. These harmful ink ingredients include lead compounds, mercury, cadmium, and chromium. Inks that contain these ingredients are noted for their high resistance to light and other chemical agents and therefore do not fade easily and are rich in appearance. However, the discouragement of their uses is that they generate "hazardous waste" (Karsnitz, 1997). The gasses they emit are harmful when inhaled or ingested and improper disposal of waste inks containing these chemicals also adversely affects the environment.

Therefore, there are legislations against the use of inks containing these ingredients especially for printing on packaging material that have direct contact with food. The Environmental Protection Agency (EPA) and the Food and Drugs Authority (FDA) as well as Non Governmental Organizations (NGO's) are fighting against the use of such inks for printing applications worldwide. New inks are being developed to replace the toxic ones, they are vegetable oil and water-based inks ("Packaging Design", 2005). These new inks are not yet the perfect substitutes for those fading away because they are not light-stable and are also susceptible to UV radiation that are used to cure varnishes.

Digital Printing on Structures

Digital printing on structures make use of three different types of inks. Water-soluble inks are used by desktop printers and solvent-based liquid inks for large format printers which are used for outdoor displays. LaserJet printers use powdered pigment colours referred to as toners which are heat-set pigments. Special finish or coating can be given to a printed

material to protect or secure the ink on a substrate by applying vanishes after printing. The coating may make the surface waterproof or resistant to abrasion. The finish can make the print appear glossier, embossed, or to have a gel-like look on the substrate. Different types of inks are developed for the diverse substrate types available today. Inks used for printing on plastic materials are different from those for paper stocks. Inks for glass are made differently from those for fabrics. ("Printing and Packaging", 2005).

It is important that the appropriate ink for the chosen substrate is used to avoid possible printing problems that may arise from using incompatible inks. For this reason, ink testing on the chosen substrate is very important. Ink smear-test, which is basic and easier to do, can be done to ensure that the ink sets well on the substrate before actual printing starts. Smear-test is done by applying a small amount of the ink on the substrate to be used, after dying the surface can be scratched, creased or folded to check if the ink film will peel or not.

The ISO standardization system

ISO (International Organization for Standardization) is a global network that identifies what International Standards are required by business, government and society, develops them in partnership with the sectors that will put them to use, adopts them by transparent procedures based on national input and delivers them to be implemented worldwide. ISO standards distil an international consensus from the broadest possible base of stakeholder groups. Expert input comes from those closest to the needs for the standards and also to the results of implementing them. In this way, although voluntary, ISO standards are widely respected and implemented by public and private sectors internationally.

ISO is a non-governmental organization and a network of the national standards bodies of some 160 countries, one per country, from all regions of the world, including developed, developing and transitional economies. Each ISO member is the principal standards organization in its country. The members propose the new standards, participate in their development and provide support in collaboration with ISO Central Secretariat for nearly 3,280 technical groups that actually develop the standards. ISO members appoint national delegations to standards committees. In all, there are some 50,000 experts contributing directly to the work of the organization each year, plus an estimated 300,000 who follow the work and provide input to national " mirror " committees.

When their work is published as an ISO International Standard, it may be translated and adopted as a national standard by the ISO members.

MODERN PACKAGING DESIGN

Application of Computers in Packaging

With the advent of computers, packaging design and printing have been greatly improved and made significant impacts in the packaging design and production workflow ("Software for Packaging Design & Pallet Loading", 2007). Computer software applications are being used for generating design concepts and for layout design of packages in a more flexible and easy way. Mechanicals needed for colour separation on films and plate making are now done on computers (Karsnitz, 1993). Hitherto, this was a complex and time consuming process which required photographic experts to handle the process cameras, These time-consuming and difficult processes have, however, been reduced to mere clicks of icons in computer software applications. Process cameras have been replaced by high resolution, image-setter" equipment. New technology referred to as computer-to-plate (CTP) systems are now taking

the place of image-setters‟ and film making by directly linking a computer to the plates processing units on press machine ("Computer to Plate", 2006). CTP is a revolutionary technology in the printing industry which is expected to bring down printing cost, time and errors. Packages can be modelled and previewed on the computer's virtual reality environment in 3Dimensional applications such as Maya, Rhinoceros and 3D Studio Max (Besel, 2007). These 3-Dimensional software are not purposely designed for the packaging industry yet they are used efficiently in the industry, especially for advertisements and for pre-testing of shrink labels and sleeves designs. The only professional software for packaging design is the CAPEPack, which has in-built features for all the technical process involved in packaging design stage to palletisation stage ("Software for Packaging Design & Pallet Loading", 2007).

Computers are employed in packaging pre-testing and other consumer surveys. Application software for Tachistoscope tests and artificial intelligence (AI) software are being used to create virtual markets for test market surveys. Computers allow packaging designers to generate different designs for a single packaging project more easily and quickly, and also to test different colour schemes for the designed packages easily and quickly on the computer without additional financial costs. Colour separation, films making, packages samples and prototypes can be previewed or printed in-house at lower costs ("Computer to Plate", 2006). Computers are facilitating quick transfers of packaging design documents from the design section in one locality to another, to be printed and, or previewed on different computerised machines anywhere around the globe at cheaper costs (Comer, 2007). Much in the same way they are used to advertise the products through the internet. Computers are made to be user friendly and can therefore be used by any computer literate person to do some form of design work. Packaging design is, however, a professional field which requires professional

packaging designers, who collaborate with other professionals or technicians to share ideas from the concept design stage to the actualization of the final packages, for the products to be marketed. A computer is a tool used in packaging design, and it requires a person with the requisite knowledge to use it. The output from the computer, therefore, depends on the competence of the user, for it is in the public domain that a computer is a "garbage in garbage out" type of gadget.

Packaging Testing

A package no matter how attractive and functional it may be, fails if it is not able to get to its destination, there is the need, therefore to test them before using them.

Package testing or packaging testing involves the measurement of a characteristic or property involved with packaging. This includes packaging materials, packaging components, primary packages, shipping containers, and unit loads, as well as the associated processes.

Testing measures the effects and interactions of the levels of packaging, the package contents, external forces, and end-use.

It can involve controlled laboratory experiments, subjective evaluations by people, or field testing. Documentation is important: formal test method, test report, photographs, video, etc.

Testing can be a qualitative or quantitative procedure. Package testing is often a physical test. With some types of packaging such as food and pharmaceuticals, chemical tests are conducted to determine suitability of food contact materials. Testing programs range from simple tests with little replication to more thorough experimental designs (Yam, K. L. 2009).

Package testing can extend for the full life cycle. Packages can be tested for their ability to be recycled and their ability to degrade as surface litter, in a sealed landfill or under composting conditions.

Purposes of Testing

Packaging testing might have a variety of purposes, such as:

- Determine if, or verify that, the requirements of a specification, regulation, or contract are met
- Decide if a new product development program is on track: Demonstrate proof of concept
- Provide standard data for other scientific, engineering, and quality assurance functions
- Validate suitability for end-use
- Provide a basis for technical communication
- Provide a technical means of comparison of several options
- Provide evidence in legal proceedings: product liability, patents, product claims, etc.
- Help solve problems with current packaging
- Help identify potential cost savings in packaging

Packaging tests can be used for:

- Subjecting packages (and contents) to stresses and dynamics found in the field
- Reproducing the types of damage to packages and contents found in actual shipments
- Controlling the uniformity of production of packages or components

Importance of testing

For some types of products, package testing is mandated by regulations: food. pharmaceuticals, medical devices and dangerous goods. This may cover both the design qualification, periodic retesting, and control of the packaging processes. Processes may be controlled by a variety of quality management systems such as HACCP, statistical process control and validation protocols. HACCP refers to Hazard analysis and critical control points, is a systematic preventive approach to food safety and allergenic, chemical, and biological hazards in production processes that can cause the finished product to be unsafe, and designs measurements to reduce these risks to a safe level. (Russel, et al 2009).

Statistical process control (SPC), on the other hand, is a method of quality control which uses statistical methods. SPC is applied in order to monitor and control a process. Monitoring and controlling the process ensures that it operates at its full potential. At its full potential, the process can make as much conforming product as possible with a minimum (if not an elimination) of waste (rework or trash). SPC can be applied to any process where the "conforming product" (product meeting specifications) output can be measured. Key tools used in SPC include control charts; a focus on continuous improvement; and the design of experiments. An example of a process where SPC is applied is manufacturing lines.

For unregulated products, testing can be required by a contract or governing specification.
The degree of package testing can often be a business decision. Risk management may involve factors such as

- costs of packaging
- costs of package testing
- value of contents being shipped

- value of customer's good will
- product liability exposure
- other potential costs of inadequate packaging

Testing with people

Some types of package testing do not use scientific instruments but use people for the evaluation.

The regulations for child-resistant packaging require a test protocol that involves children. Samples of the test packages are given to a prescribed population of children. With specified 50-child panels, a high percentage must be unable to open a test package within 5 minutes. Adults are also tested for their ability to open a C-R (Child-Resistant) package.

According to Dvorak, (2008), consumer packages are often evaluated by focus groups. People evaluate the package features in a room monitored by video cameras. The consumer responses are treated qualitatively for feedback into the new packaging process.

Some food packagers use organoleptic evaluations. This refers to the use senses (taste, smell, etc.) to determine if a package component has tainted the food in the package.

A new package may be evaluated in a test market that uses people to try the packages at home. Consumers have the opportunity to buy a product, perhaps with a coupon or discount. Return postcards or internet sites provide feedback to package developers. Perhaps the most critical feedback is repeated sales items in the new package. Packaging evaluations are an important part of marketing research.

Legibility of text on packaging and labels is always subjective due to the inherent variations of people. Efforts have been made to help better quantify this by people in a laboratory: still using people for the evaluation but also employing a test apparatus to help reduce variability.

Some laboratory tests are conducted but still result in an observation by people. Some test procedures call for a judgment by test engineers whether or not pre-established acceptance criteria has been met.

Packaging Testing Equipment

Many equipment have been invented for the purposes of testing the effects and interactions of the levels of packaging, the package contents, external forces, and end-use, as stated earlier. These equipment the drop tester, environmental chamber, the joint tester, bend tester, compression tester, water spray tester and transportation tester as displayed below. Their names describe their uses.

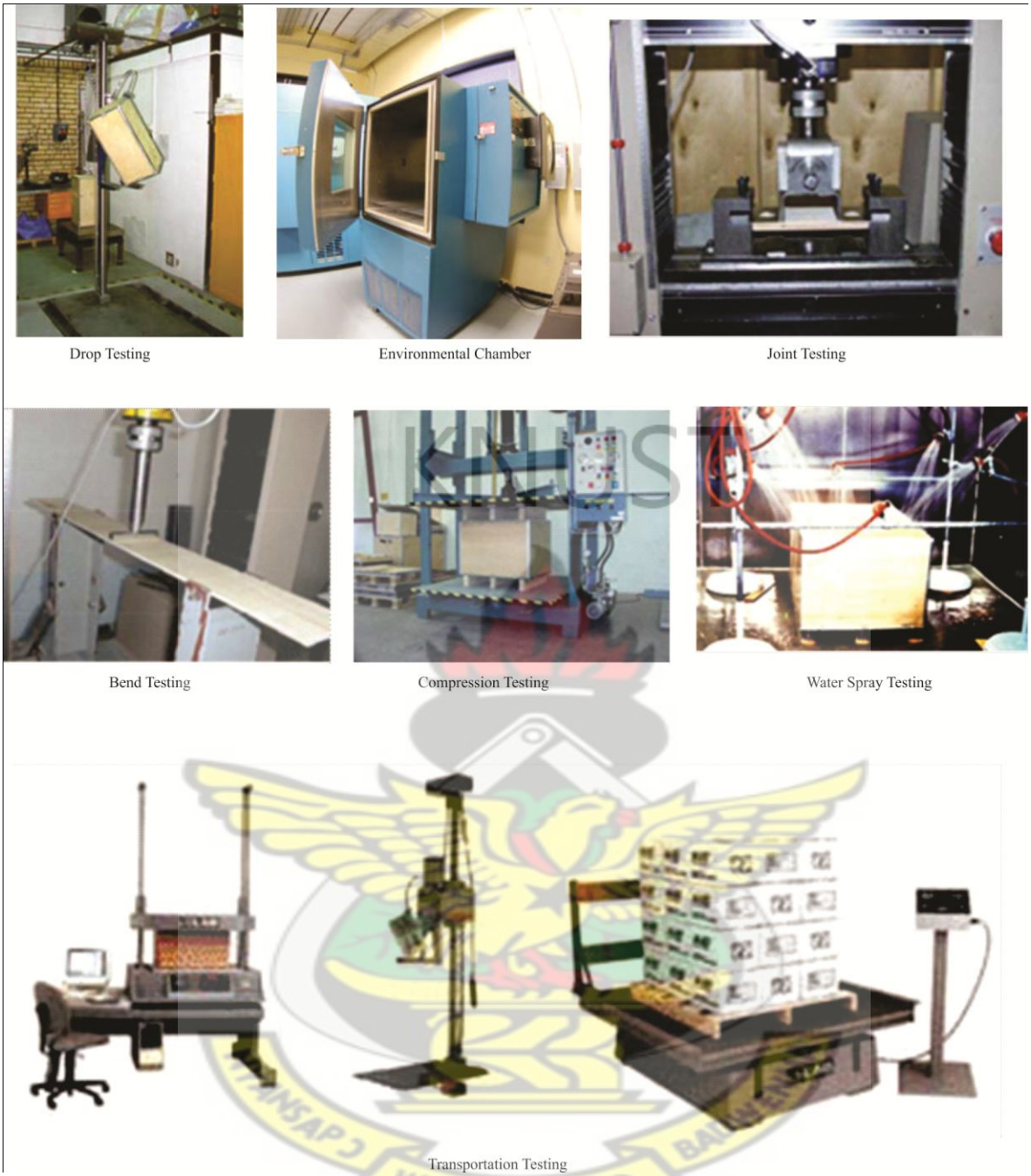


Figure 2.6: Some Packaging Testing Equipment (www.nefab.com)

Transport packaging and their contents are influenced by the modes of transport. Depending on which transport mode that is used, packages will be exposed to different kind of stresses. The main stresses are;

1. Mechanical Strains - The most common mechanical strains on transported goods are force stresses like, stacking pressure and shocks and energy stresses like vibration and dropping.
2. Climatic Stresses - Climate plays a vital part for the durability and performance of the packaging during the transport.

Transportation Modes

The method of transportation presents a number of potential strains on the packaging. Below are examples depending on transportation mode;

Sea Freight Rolling, Lifting, Pitching, Yawing, Jarring

Air Freight Acceleration, Retardation, Lifting, Dropping, Pitching, Jarring

Rail Transport Acceleration, Shunting shocks, Centrifugal forces, Jarring

Road Transport Acceleration, Retardation, Centrifugal forces, Jarring

Testing Methods

Packaging is tested in two ways;

i) regarding their material performance, and

ii) how they perform during the actual transportation.

Transportation Packaging Testing

A transportation testing program is divided into different stages which follows the distribution chain. The testing programs represent the "highest normal" strains that will occur during a transport. The different tests that can be performed are described below;

Drop Test

The test simulates actual shocks by dropping the package and its content freely against a rigid plane surface from a predetermined height. For example, a drop test can be conducted so that the package hits the surface diagonally against one corner, as in the picture beside.

The Compression and Stacking Tests

This test is performed to assess the ability of a transport package to withstand compressive forces and to protect its contents during compression. The test may also be used as a stacking test to investigate the performance of the bottom package in a stack during storage in a warehouse.

The Vibration Test

Various forms of transportation vibrations can be simulated in a laboratory through a vibration test. The test-bench can be made to swing and vibrate in almost any direction with a number of frequencies and amplitudes to emulate the transportation being used.

The Horizontal Impact Test

Horizontal shocks are simulated by applying a horizontal velocity to the test specimen and bringing it to halt by impact with a vertical impact surface.

The Water-Spray Test

The test is designed so that each area of the top surface of the package is sprayed with water maintained at a constant temperature at a specified rate for a specified period. The test package shall be filled with its intended contents and closed normally, as if ready for distribution.

The Rolling and Toppling Test

In a rolling test the package is placed on a horizontal impact surface with the resting surface down. The package is tilted until the point of balance on this edge is reached. Then it is permitted to overbalance without thrust so as to impact on the surface. This procedure shall be repeated until all six sides have been impacted.

Packaging Material Testing

Material tests are used for all kind of materials used as packaging material. The tests are;

- **Bending Test:** the ability of the package to withstand compression is based on the bending strength and bending stiffness of the sheet material. Therefore this is a vital test to perform in order to get the best possible packaging.
- **Moisture Absorption Test** - In order to determine the plywood box's capability to protect the goods from moisture and to establish how moisture resistant the actual box will be a moisture absorption test is performed on the different batches of plywood used.
- **Cutting–strength test:** The cutting-strength test is performed to establish the strength of the glue, which holds the veneers of ply together to form the plywood-sheet. The testing methods vary a bit depending on the bonding material used in the plywood.

- **Testing of Glue–Joints: -** This test is very similar to the one used to measure the strength of the plywood. However, unlike that test the pressure is applied on both sides of the glue-joint, in order to get the maximum strain on the joint.
- **Joint Test, sheet/steel (tongues and klammerband) material** - The aim of this test is to determine the strength of the joint between the steel and the sheet material.

Testing Standards

There are a number of different testing standards on the market and each standard has different severity levels. The important thing when choosing the right standard and the right severity level is to have a dialogue between all the concerned parties

Early on in the 1960's, tachistoscopes were used in testing. A tachistoscope is a device that displays an image for a specific amount of time. It can be used to increase recognition speed, to show something too fast to be consciously recognized, or to test which elements of an image are memorable. Projection tachistoscopes use a slide or transparency projector equipped with the mechanical shutter system typical of a camera. The slide is loaded, the shutter locked open, and focusing and alignment are adjusted, then the shutter is closed. When ready for the test, a shutter speed is selected, and the shutter is tripped normally.

Challenges of the Structural Packaging Industry

Like any other industry, the structural packaging industry the world over, is bedeviled with many challenges.

According to Scot Young (2004), the current energy surrounding packaging innovation represents a wonderful opportunity to differentiate and add value through effective design.

However, it also poses some interesting challenges for design professionals, most notably that of justifying the significant investments required (in retooling, in higher costs per unit, and so on) for a new packaging system. This is a challenge to manufactures as well.

Guidelines for Management of Packaging Waste

Structural packages, no matter how beautiful they look, would finally be disposed of. There is, therefore, the need to devise means of properly disposing of these waste.

Proper waste management is important to protect human health and the environment and to preserve natural resources. The Environmental Protection Agency (EPA) strives to motivate behavioral change in solid waste management through non-regulatory approaches, including pay-as-you-throw and WasteWise in the USA. In pay-as-you-throw systems, residents are charged for waste management services on the basis of the amount of trash they discard. This creates an incentive to generate less trash and increase material recovery through recycling and composting.

Source reduction

Source reduction (that is, waste prevention) is reducing the amount and/or toxicity of the waste ultimately generated by changing the design, manufacture, purchase, or use of the original materials and products. EPA considers source reduction the best way to reduce the impact of solid waste on the environment because it avoids waste generation altogether. Source reduction encompasses using less packaging, designing products to last longer, and reusing products and materials (EPA 2002). Specific ways to achieve source reduction include lightweighting packaging materials, purchasing durable goods, purchasing larger sizes (which use less packaging per unit volume) or refillable containers, and selecting toxic-free products. Overall, source reduction has many environmental benefits, including

conservation of resources, protection of the environment, and prevention of greenhouse-gas formation.

Light weighting

One way to achieve source reduction is through lightweighting, which is using thinner gauges of packaging materials either by reducing the amount used or by using alternate materials. Girling (2003) reported that the average weight of glass containers decreased by nearly 50% from 1992 to 2002. Similarly, aluminum cans were 26% lighter in 2005 than in 1975, with approximately 34 cans being made from 1 pound of aluminum, up from 27 cans in 1975 (Aluminum Assn. 2006). According to EPA (2004), Anheuser-Busch Companies Inc. lightweighted their 24-ounce aluminum cans in 2003, which resulted in reducing the use of aluminum by 5.1 million pounds. The amount of aluminum used in foil laminates has also been reduced. Moreover, steel cans have been lightweighted, with cans now at least 40% lighter than those of 1970. (EPA 2004).

Reusable and refillable containers

Another way to achieve source reduction is through reuse. For example, some glass containers, especially bottles, are frequently reused after washing with powerful detergents. Plastic refillable containers are commonly made from PETE, PEN, or high-density polyethylene. This is partly because collecting, transporting, and cleaning such containers offers logistical difficulties that lead to manufacturing preferences for 1-way containers.

Furthermore, manufacturers have achieved source reduction by offering refill products, particularly with nonfood items such as household cleaners. Refillable glass containers for beverage use have been mostly replaced with thinner 1-way glass or plastic containers because of transportation costs and cleaning requirements. However, refillable glass

containers are still prevalent in many countries. PETE containers have been depolymerized and repolymerized to avoid any potential problems with contamination through postconsumer waste streams, but the process has not been economically practical.

Recycling

Recycling diverts materials from the waste stream to material recovery. Unlike reuse, which involves using a returned product in its original form, recycling involves reprocessing material into new products. A typical recycling program entails collection, sorting and processing, manufacturing, and sale of recycled materials and products. To make recycling economically feasible, recycled products and materials must have a market.

Almost all packaging materials (glass, metal, thermoplastic, paper, and paperboards) are recyclable. Various factors play into any economic assessment of recycling, including costs for collection, separation, cleaning or reprocessing, and transportation (energy). There also needs to be a market and application for recycled products and the existence of competing materials. For instance, materials reclaimed through metal and glass recycling are considered safe for food contact containers because the heat used to melt and form the material is sufficient to kill microorganisms and pyrolyze organic contaminants. Although the reprocessing of plastics also utilizes sufficient heat to destroy microorganisms, it is not sufficient to pyrolyze all organic contaminants, and postconsumer recycled plastics are not generally used in food contact applications.

Composting

Composting is a form of recycling. Composting is the controlled aerobic or biological degradation of organic materials such as food and yard wastes. Accordingly, it involves arranging organic materials into piles and providing sufficient moisture for aerobic

decomposition by microorganisms. Periodic turning of the piles promotes aeration to prevent anaerobic conditions. The resulting humus, a soil-like material, is used as a natural fertilizer, thereby reducing the need for chemical fertilizers.

Combustion/incineration

Combustion, defined as the controlled burning of waste in a designated facility is an increasingly attractive alternative for waste that cannot be recycled or composted. Reducing waste volume by 70% to 90%, combustion incinerators can be equipped to produce steam that can either provide heat or generate. In fact, plastics are derived from petroleum feedstocks and possess a high heat content that is advantageous for waste-to-energy incineration. There are 3 types of incinerators, also known as municipal waste combustors (MWCs): mass-burn incinerators, refuse-derived fuel incinerators, and modular combustors.

Mass-burn incinerators

Mass-burn incinerators accept all types of solid waste except for items that are too large to go through the feed system. Integrated waste is placed on a grate that moves through the combustor while air is forced into the system above and below the grate to promote complete combustion.

Refuse-derived fuel incinerators

Refuse-derived fuel (RDF) incinerators use waste that has been preprocessed to remove noncombustibles and recyclables. The combustibles are shredded into a uniform fuel that has a higher heating value. An RDF facility may be equipped for only processing or combustion, or both (Kiser & Zannes 2004).

Modular combustors

As with mass-burn incinerators, modular combustors accept all waste without preprocessing but are typically smaller than mass burn. They are usually prefabricated off site and can be quickly assembled wherever they are needed.

Land filling

Landfills provide environmentally sound disposal of any remaining solid waste and the residues of recycling and combustion operations. The location and operation of landfills are governed by state regulations, and today's landfills are carefully designed structures in which waste is isolated from the surrounding environment and groundwater. A properly designed landfill manages leachate and collects landfill gases (methane and others) for potential use as an energy source. The growing awareness of environmental problems, including increased use of synthetic packaging materials coupled with slow degradation in landfills, has prompted the development of advanced landfill technology, environmental regulations for landfills, and biodegradable packaging materials.

The Nature of Packaging Materials, their Properties and Considerations for Usage

The key to successful packaging is to select the package material and design that best satisfies competing needs with regard to product characteristics, marketing considerations (including distribution needs and consumer needs), environmental and waste management issues, and cost. Not only is balancing so many factors difficult, but also it requires a different analysis for each product, considering factors such as the properties of the packaging material, the type of food to be packaged, possible food/package interactions, the intended market for the product, desired product shelf-life, environmental conditions during storage and distribution, product end use, eventual package disposal, and costs related to the

package throughout the production and distribution process. Some of these factors are interrelated: for example, the type of food and the properties of the packaging material determine the nature of food–package interactions during storage. Other times, the factors are at odds with each other: for example, single-serving packaging meets consumer needs, but bulk packaging is better for environmental reasons.

	Product characteristics/Food compatibility		Consumer /marketing issues		Environmental issues		
Material	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**	**Cost**
Glass	-Impermeable to moisture and gases -Non-reactive (inert) -Withstands heat processing	-Brittle and breakable -Needs a separate closure	-Transparent -Allows consumer to see product -Can be coloured for light-sensitive products	-Poor portability, heavy and breakable	-Reusable -Recyclable -Often contains recycled content	-Heavy and bulky to transport	-Low cost material, but somewhat costly to transport
Aluminum	-Impermeable to moisture and gases -Resistant to corrosion -Withstands heat processing	-Cannot be welded -Limited structural strength	- Easy to decorate - Lightweight -Good portability -Unbreakable	-Limited shapes	-Recyclable -Lightweight -Economical	-No disadvantages in rigid form -Separation difficulties in laminated form	-Relatively expensive, but value encourages recycling
Tinplate	-Impermeable -Strong and formable -Resistant to corrosion -Withstands heat processing	-Can react with food -Coating required	- Easy to decorate	-Typically requires a can opener to access product	Recyclable -Magnetic, thus easily separated	-Heavier than aluminum	-Cheaper than aluminum
Tin-free steel	-Strong -Good resistant to corrosion -Withstands heat processing	-Difficult to weld, requires removal of coating -Less resistant to corrosion	- Easy to decorate	-Typically requires a can opener to access product	-Recyclable -Magnetic, thus easily separated	-Heavier than aluminum	Cheaper than tinplate
Polyolefin	-Good moisture barrier -Strong -Withstands chemicals	-Poor gas barrier	- Lightweight	-Sight haze or translucency	-Recyclable -High energy source for incineration	-Easily recycled in semi-rigid form, but identification and separation more difficult for films	-Low cost
Polyesters	-Strong -Withstands hot filling -Good barrier properties		-High clarity -Shatter resistant		-Recyclable	-Easily recycled in rigid form, but identification and separation more difficult for films	-Inexpensive, but higher cost among plastics
Polyvinyl Chloride	-Moldable -Resistant to chemicals		-High clarity		-Recyclable	-Contains Chlorine -Requires separating from other waste	-Inexpensive
Polyvinylidene Chloride	-Higher barrier to moisture and gases -Heat Sealable -Withstands hot filling		-Maintains product quality		-Recyclable	-Contains Chlorine -Requires separating from other waste	-Inexpensive, but higher cost among plastics
Polystyrene	-Available in rigid, film and foam form	-Poor barrier properties	-Good clarity		-Recyclable	-Requires separating from other waste	-Inexpensive
Polyamide	-Strong -Good barrier properties				-Recyclable	-Requires separating from other waste	-Inexpensive, but higher cost among plastics
Ethylene vinyl alcohol	Higher barrier to gases and oil/fat	-Low moisture barrier -Moisture sensitive	-Maintains product quality for oxygen-sensitive products		-Recyclable	-Requires separating from other waste	-Inexpensive when used as thin films
PLA	Biodegradable hydrolysable				-Recyclable	-Requires separating from other waste	-Relatively expensive
Paper and paperboard	Very good strength to weight characteristics	-Poor barrier to light -Recycled content makes it unsuitable for food contact material	-Low density -Easily decorated	-Moisture sensitive -Loses strength with increasing humidity -Tears easily	-Made from renewable resources -Recyclable		-Low cost
Laminates/ coestrusions	Properties can be tailored to product needs		-Efficient, low cost protection -Flexibility in design and characteristics		-Often allows for source reduction	-Layer separation is required	-Relatively expensive, but cost effective for purpose

*All thermoplastics are technically recyclable and are recycled at the production environment, which contributes to lower cost. As inexpensive materials, postconsumer recycling competes with case of separating and cleaning the materials

*Recycled extensively for non-food product uses

Table 2: The Nature of Packaging Materials, their Properties and Considerations for Usage (ITO 2010)

Product characteristics

A thorough knowledge of product characteristics, including deterioration mechanisms, distribution needs, and potential interactions with the package, is essential for package design and development. These characteristics concern the physical, chemical, biochemical, and microbiological nature of the product. Materials that provide optimum protection of product quality and safety are most preferred. Similarly, distribution systems and conditions help determine the type of packaging material used.

In particular, product/package interaction plays an important role in the proper selection of packaging materials for various applications. Each packaging material has different inherent properties (for example, rigidity and permeability to gases). These properties affect the selection of which material is best for a particular product, given the characteristics of that product (for example, acidity and light sensitivity).

Package interaction involves the transportation of low molecular weight compounds such as gases or vapors and water from (1) the product through the package, (2) the environment through the package, (3) the product into the package, and/or (4) the package into the product (IFT 1988). It may also include chemical changes in the product, package, or both. These interactions result in product contamination, especially food (a potential health issue), loss of package integrity (a potential safety issue), or decrease in quality.

The most common package interactions are the migration of low molecular weight substances such as stabilizers, plasticizers, antioxidants, monomers, and oligomers from plastic packaging materials into product such as food (Arvanitoyannis & Bosnea 2004). Furthermore, low molecular weight compounds (volatile and nonvolatile) may migrate from food into packaging materials through the sorption mechanism (Hotchkiss 1997). The volatile

substances such as flavours and aromas directly affect product quality while the nonvolatile compounds such as fat and pigments affect the package (Tehrany & Desobry 2004).

Marketing

Marketing is a prerequisite to successful innovation in the packaging industry; it promotes products in a competitive marketplace and increases consumer choice (Coles 2003). Consumers are consistently looking for packages that offer convenience attributes such as resealability, container portability (lightweight materials preferred), ease of opening, convenient preparation features, and product visibility.

Environmental characteristics

As a comprehensive analysis of the material from production to disposal, life cycle analysis is important in determining the environmental impact of a package. The analysis incorporates a quantitative evaluation of environmental costs, considering issues such as material use, energy consumption, and waste generation (Smith & White 2000). The sustainability goal inherent within the cradle-to-cradle concept (imposing zero impact on future generations) builds on life cycle analysis to address material and energy recovery as well (McDonough & Braungart 2002). Furthermore, new packaging materials are being developed to facilitate the goal of true sustainability.

Balancing priorities

Ideally, a food package would consist of materials that maintain the quality and safety of the food indefinitely with no degradation over time; are attractive, convenient, and easy to use while conveying all pertinent information; are made from renewable resources, generating no waste for disposal; and are inexpensive. Rarely, if ever, do today's food packages meet this

lofty goal. Creating a food package is as much art as science, trying to achieve the best overall result without falling below acceptable standards in any single category (an exercise in balancing and negotiation).

From a product characteristic perspective, the inertness and absolute barrier properties of glass make it the best choice material for most packaging applications. However, the economic disadvantage of glass boosts the use of alternatives such as plastic. While plastics offer a wide range of properties and are used in various food applications, their permeability is less optimal—unlike metal, which is totally impervious to light, moisture, and air. Attempts to balance competing needs can sometimes be addressed by mixing packaging materials—such as combining different plastics through co-extrusion or lamination—or by laminating plastics with foil or paper.

Ultimately, the consumer plays a significant role in package design. Consumer desires drive product sales, and the package is a significant sales tool. Although a bulk glass bottle might be the best material for fruit juice or a sport beverage, sales will be affected if competitors continue to use plastic to meet the consumer desire for shatterproof, portable, single-serving containers.

Conclusion

The primary purpose of packaging must continue to be maintaining the safety, wholesomeness, and quality of the product, achieved by its attractiveness through the structural design and graphics on the package. The impact of packaging waste on the environment can be minimized by prudently selecting materials, following EPA guidelines, and reviewing expectations of packaging in terms of environmental impact. Knowledgeable efforts by industry, government, and consumers will promote continued improvement, and an

understanding of the functional characteristics of packaging will prevent much of the well-intentioned but ill-advised solutions that do not adequately account for both preconsumer and postconsumer packaging factors.

CHAPTER THREE

METHODOLGY

This chapter gives account of the processes used for the data acquisition; including how the research was planned, the research design that was used, the sample used and data collecting procedures for each of the three objectives which are:

1. Design and create sample packaging structures of locally made products
2. Assess the impact of the packaging structures

The chapter begins with the study area, population and sampling techniques as well as analytical procedures. The chapter further deals with the presentation of data gathered, sampling techniques, instruments for data collection and sources of data, as well as scope and limitations of the methodology.

The Study Area

The study area consisted of all stakeholders in the packaging industry, especially The Institute of Packaging, Ghana (IOPG), The Ghana Standards Authority (GSA), The Food and Drugs Authority (FDA) Shop Operators and attendants, among others.

This study sought to do an exploration of the concept of standout in structural designs, hence the title "**Exploring the concept of standout in packaging through structural designs. Challenges and Prospects.** Accra and Kumasi, the two major metropolises, were selected for the research because of their relatively very high population densities. Some of the large and small scale business enterprises and organisations within the packaging industry were visited to enable the researcher reach experts in the field of work and also to be acquainted with how the packaging and its related activities are performed in the industry. Some of the local packaging companies within the packaging industry visited include the Coca Cola Bottling

Company of Ghana –Accra and Kumasi, Guinness Ghana Limited- Kumasi, Unilever (Ghana) limited- Tema, Voltic (Gh) Limited (Accra), Nestle (Gh) Limited (Tema), Poly Pet Limited (Accra), Polytex (Gh) Limited (Accra), Danica Plastics (Accra), Everpure (Kumasi), Sikaboat Plastics (Kumasi), Aboso Glass Factory, (Aboso). The rest are The Institute of Packaging, Ghana (IOPG), Accra, and The Ghana Standards Authority (Accra). Experts spoken to include Mr. Amuzu of Danica Plastics (Accra), Mr. Seshie of Polytex, Accra, Mr. Rajesh of Poly print, Accra, Mr. Mante of IOPG, Accra, Mr. Boateng of Sikaboat Plastics, Kumasi, Mr. Nkrumah, Nana Amantana, Nana Kwenin and Mr. Kinglsley Sam, all of whom worked with the Aboso Glass Factory. The convenience sampling technique was used for the selection of consumers across the metropolises to assess their choice of a product based on their structural designs. Though there are many packaging materials as regards structures as discussed in the previous chapter, the researcher decided to concentrate on paper and Glass. However, for the purposes of the study, paper was used for the suggested structural package designs.

For this study, the population was in four sets. These include the manufacturers, shopping mall operators, consumers and the packaging related institutions. These groups of population had distinct and varied characteristics as well as different population sizes and were targeted given the dynamics of the research questions and objectives for this study. In the case of the institutions, the total population was determined by a set criterion, which was that, any institution whose modus operandi related to inspection of products in any way or the packaging industry would be selected.

Given the purpose of the study, the research questions and objectives, the selection of manufacturers was based on the fact that, such manufacturers should be producing a product which demands a good package, especially as regards their structures to be able to be

marketed well and also the manufacturers should be within the geographical setting of the study.

Although as many companies as possible were targeted for the research, very few of them became accessible due to fears that information could be used for purposes other than the one stated on the interview guide.

Population

A research population can be defined as the totality of a well-defined collection of individuals or objects that have common, binding characteristics or traits. The population for this study comprised of all stakeholders in the packaging industry, with special emphasis on the structures of the packages, general consumers, mall supervisors/owners and attendants, and manufacturers. The research covers a population of about eighty (80) stakeholders in the packaging industry.

Sample and Sampling Techniques

In conducting a research study, it is practically impossible, time-consuming and too expensive to test every individual in the entire population. Therefore smaller chunks of a unit sample are chosen to represent the relevant attributes of the whole of the units (Graziano & Raulin, 1997). The convenience sampling method was therefore adopted for this study.

Classification of Respondents and Sample Size

Respondents Category	Population
Manufacturers	20
Institute of Packaging Ghana (IOPG)	1
Ghana Standards Authority	1
Food and Drugs Authority	1
Shop Operators	20
Shop Attendants	20
General Consumers	17
Total	**80**

Table 3.1: Classification of Respondents and Sample Size

Data Collection Instruments

The data collection methods or techniques formed an important part of this research. According to Patton (2002) using more than one data collection instrument strengthens and gives credibility to the study. The use of more than one data collection instrument portrays a true picture of the case under study. In this regard, the researcher gathered the required data from two (2) different sources. This approach was used because it revealed issues that could not be raised in using only one data collection instrument. The study made use of primary and secondary data sources in order to gather relevant information for the study.

Primary Data

The main research instruments used were interviews, questionnaires and field observations. This was done with the focus on the objectives set in the study. The primary data were collected from the selected respondents within the sample frame in the research population.

Some of the local packaging companies within the packaging industry consulted include the Coca Cola Bottling Company of Ghana –Accra and Kumasi, Guinness Ghana Limited- Kumasi, Unilever (Ghana) limited- Tema, Voltic (Ghana) Limited (Accra), Nestle (Ghana) Limited (Tema), Poly Pet Limited (Accra), Polytex (Ghana) Limited (Accra), Danica Plastics (Accra), Everpure (Kumasi), Sikaboat Plastics (Kumasi), Aboso Glass Factory, (Aboso). The rest are The Institute of Packaging, Ghana (IOPG), Accra, and The Ghana Standards Authority (Accra). Experts spoken to include Mr. Amuzu of Danica Plastics (Accra), Mr. Seshie of Polytex, Accra, Mr. Rajesh of Poly print, Accra, Mr. Boateng of Sikaboat Plastics, Kumasi, Mr. Nkrumah, Nana Amantana, Nana Kwenin and Mr. Kinglsley Sam, all of the now defunct Aboso Glass Factory, Aboso, among others. The analysis of the study was substantially based on this data.

Secondary Data

The researcher himself referred to various publications of foreign and local origin, books, journals, articles, newspapers, reports obtained from libraries and the internet on the subject to obtain additional information in order to answer the questions set in the problem definition. These documents were gathered from libraries visited which include the following:

- The various libraries, KNUST, Kumasi;
- The British Council library, Kumasi;
- The Ghana Standards Authority (GSA) library, Accra
- The Institute of Packaging, Ghana (IOPG) library, Accra.
- The personal libraries of Lecturers: Mr. Adam Rahman and Mrs. J.J. Stuber
- Internet facilities on and off KNUST campus

Questionnaire Design

The research questions were developed by the researcher. Subsequently, a pilot test of the questionnaire and interview was conducted for ten (10) participants in order to identify and eliminate potential ambiguity in the questionnaire. The questionnaire was designed to help collect information from all stakeholders in the packaging industry whose inputs are needed in the research.

The instrument (questionnaire) consisted of the following sections: personal and general information from the participants using objective test and information on respondent's perception on the issues at stake.

Questionnaire Administration

The questionnaires were self-administered on one-to-one basis to the respondents willing to fill or provide answers. The completed questionnaire was taken by the researcher either on the same day or on a day scheduled by the respondent. The primary data collected was reviewed by the researcher to ensure maximum accuracy, legibility, completeness, consistency and to reduce ambiguity.

The Research Design

Research design is not just a work plan but it is a tool that enables the researcher to ensure that the evidence obtained answer the questions under investigation in a research, as unambiguously as possible (De Vaus, 2001). There are three main research approaches: qualitative, quantitative and mixed approach that can be adopted for a study. For this study however, the qualitative method was used.

Qualitative data are often expressed verbally in order to understand a social or human problem through pictures and words in a natural setting, to which infographic charts are assigned and measured statistically (Cresswell, 1994).

Data Analysis

The Statistical Package for Social Sciences (SPSS) was used for data entry and analysis of the data collected. Data preparation was the initial step to convert raw data into structured format that was more appropriate for the analysis.

Limitations and Scope of Research

One of the problems faced during the research was the issue of indifference and trust on the part of some respondents when it comes to packaging and structural packaging, for that matter. Another problem encountered was difficulty in gaining access to shop owners, especially the supermarkets and attendants and even some shoppers. Access to the factories of expatriate manufacturers was also a huge challenge due to what the researcher perceived to be lack of trust. Their usual excuse was that they were busy. An alternative method of interviewing was used by the researcher at the convenience of the interviewees. Time and lack of financial resources were also problems encountered during the research.

DESIGNING AND MAKING OF PACKAGING STRUCTURES

One of the research questions the researcher asked was "*What innovative shapes could the structure of packages be made into to improve packaging in Ghana?*

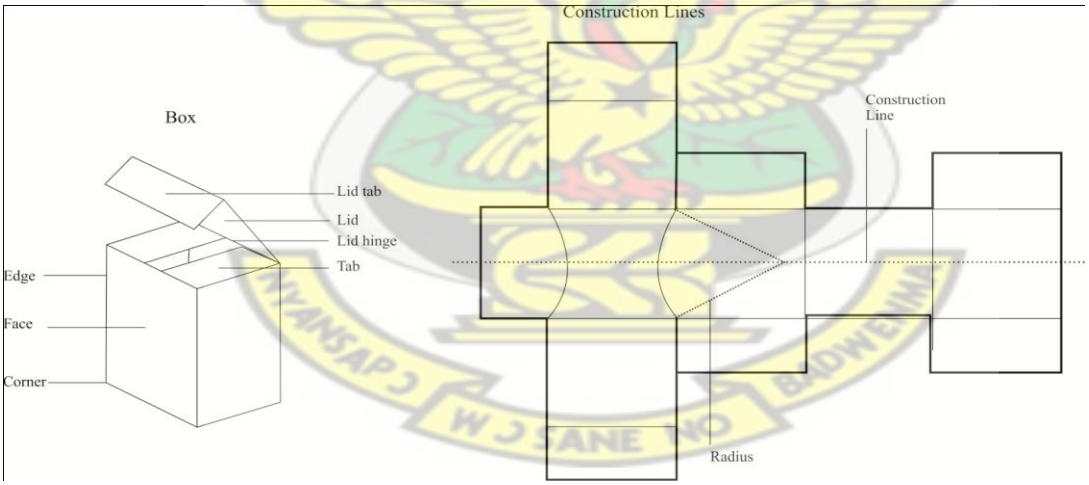
In an attempt to answer this question, the researcher embarked upon a vigorous study of the packaging software Artios CAD as well as studied the shapes of existing local packaging structures so as to be able to design more attractive and appealing packages to promote the

patronage of locally-made products. It is the firm belief of the researcher that these alternative packages will set the stage for consumers to appreciate innovative structural packaging.

As stated earlier, there are many materials that can be used in making packaging structures, but for convenience sake, this researcher opted to use paper in designing the suggested packaging structures.

Procedure

After designing the structure on the computer, using their construction lines, it is printed out, cut out using the utility knife along the construction lines. 2-dimensional or 3-dimensional CAD software such as Artios CAD and Maya may be used for the design. During the cutting process, the solid black outlines are cut out whilst the thin, broken lines are scored using the paper scorer.



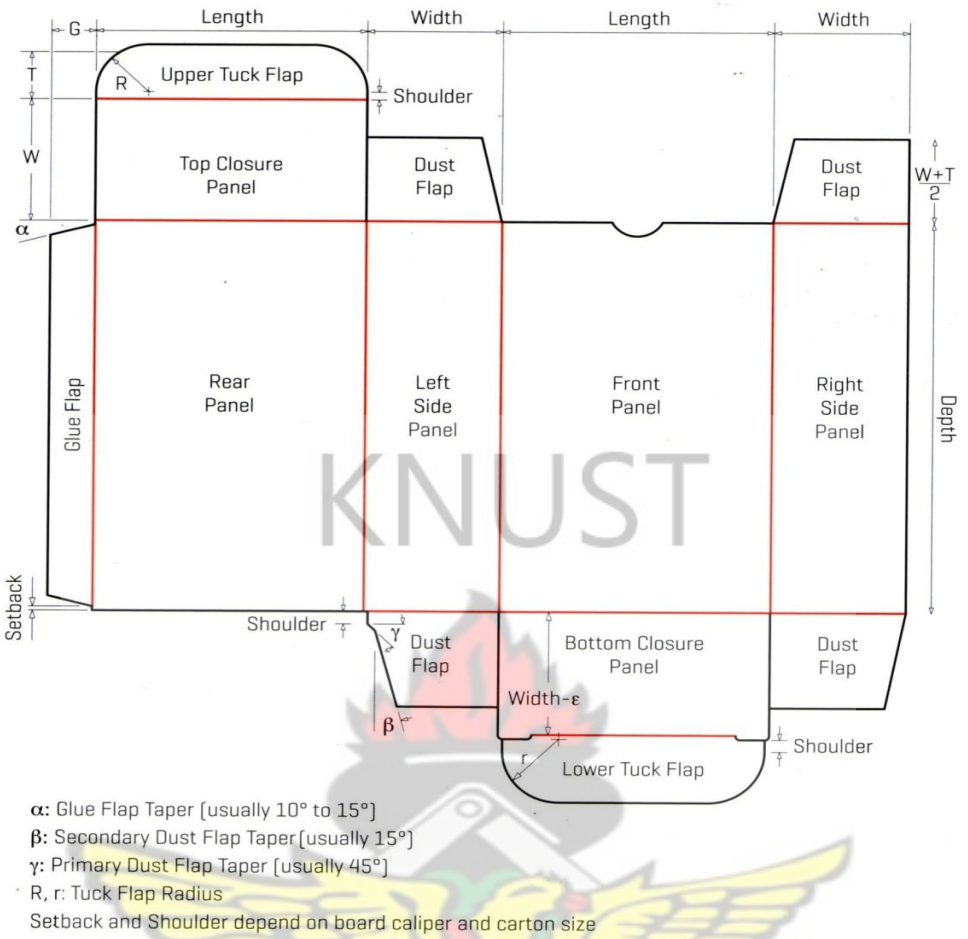
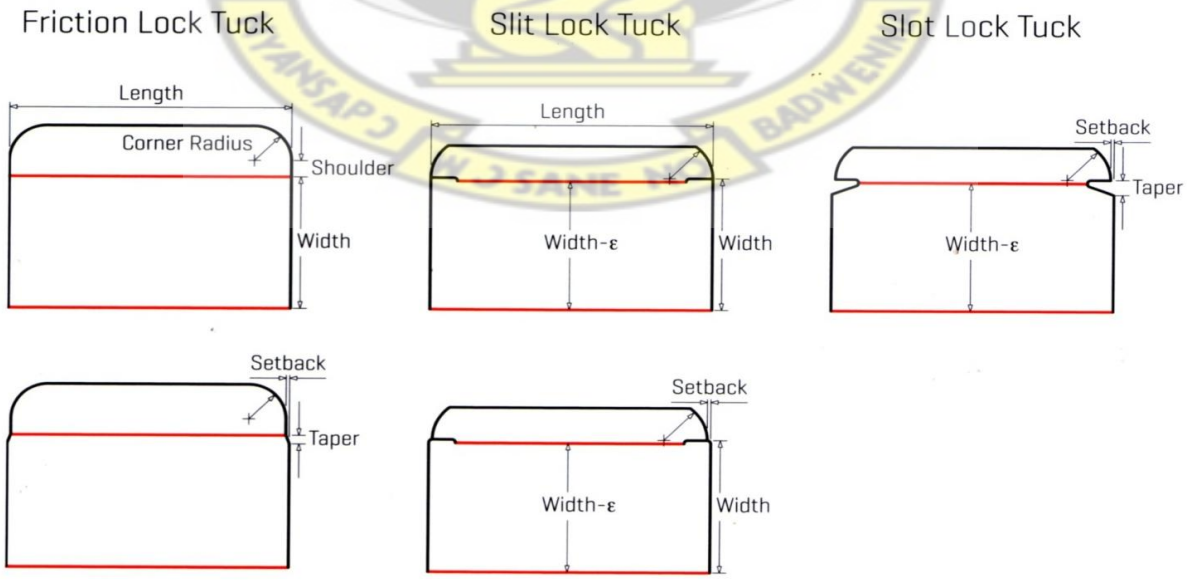


Figure 3.1: Parts of a Box and Construction lines (Source: Complex Packaging, 2010)



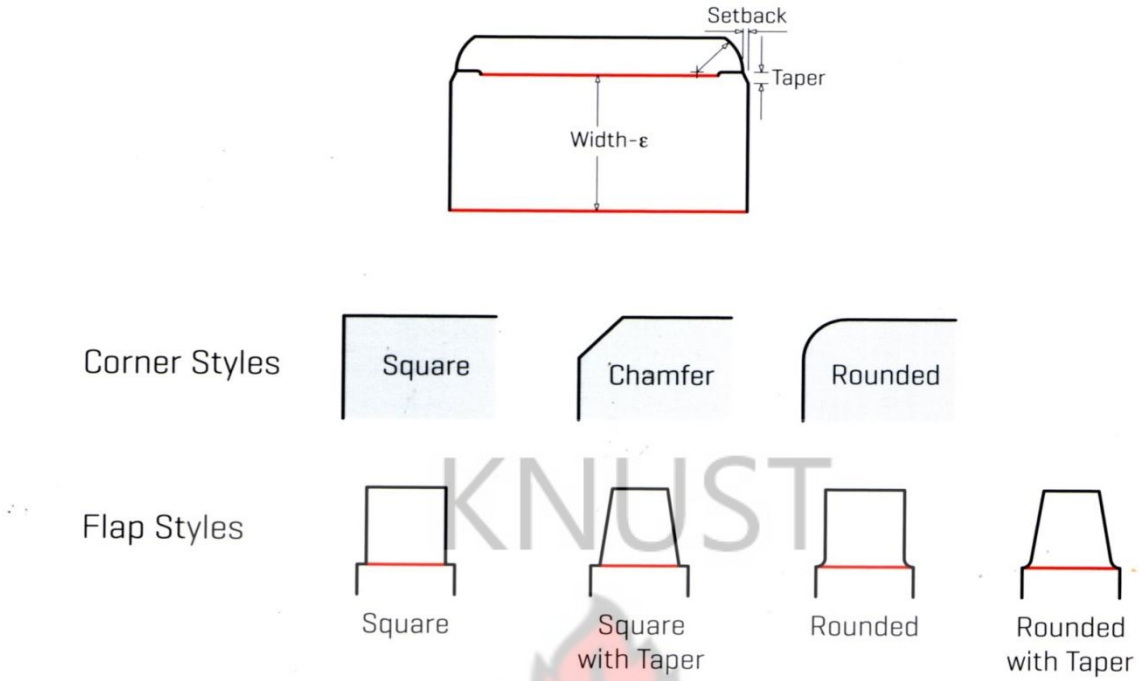
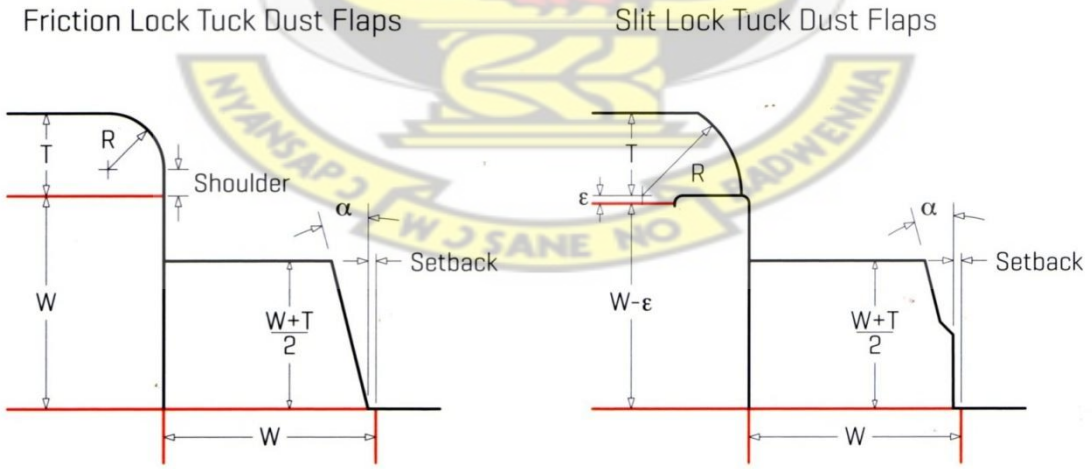


Figure 3.2: Friction, Slit and Slot Lock Tucks

(Source: Complex Packaging, 2010)



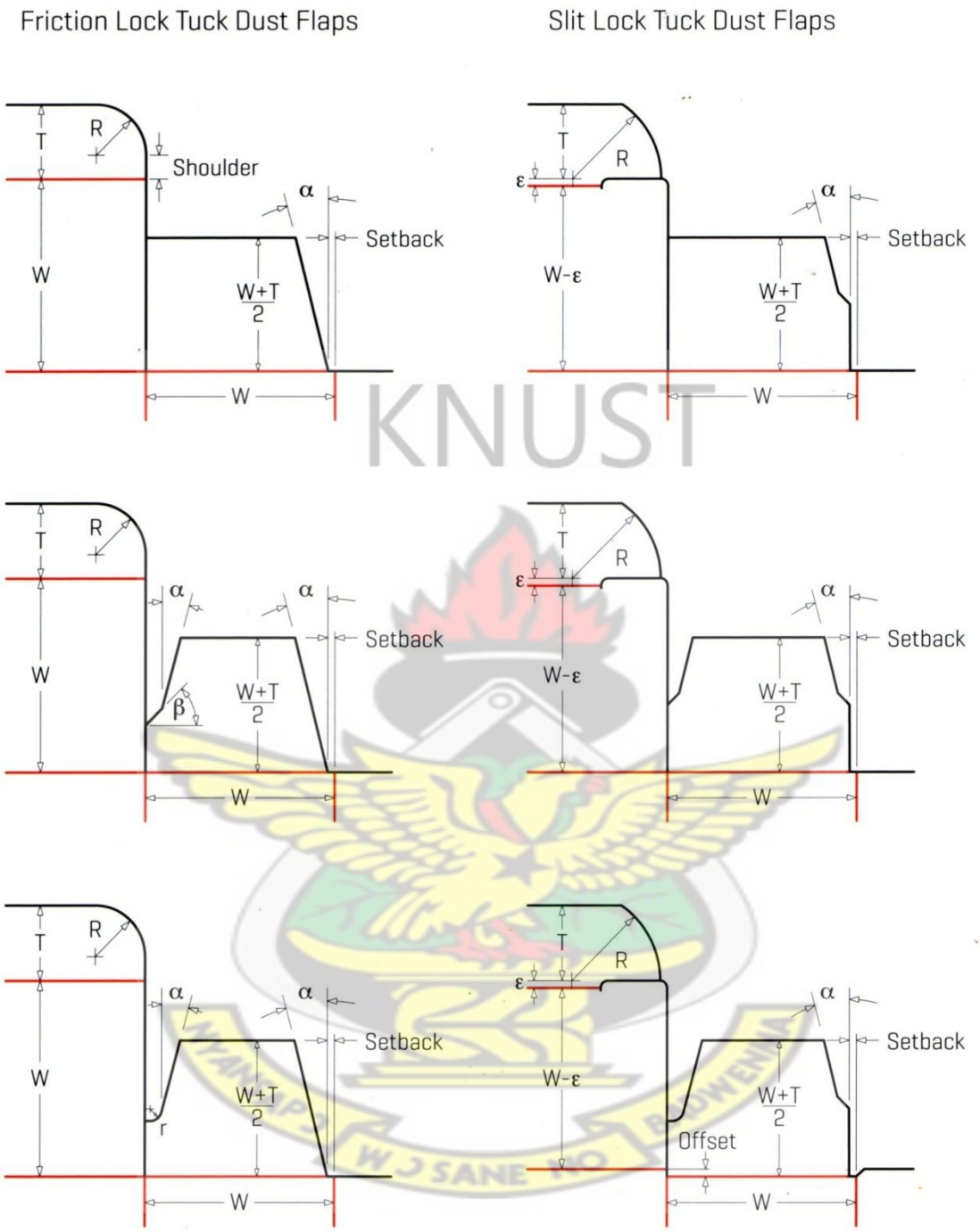


Figure 3.3: Friction, Lock Tucks Dust Flaps and Slit Lock Tuck Dust Flaps

(Source: Complex Packaging, 2010)

Packaging Dimensions

In designing a package, the most important factor to consider is the dimensions of the product to be packaged. There are, however, additional matters to consider, such as leaving space for protective padding of a linear, the outside dimensions of the package and how it can be stacked and or fit onto a pallet, material waste during production and productions speed.

Cutting

After designing the package structure using Artios CAD, there was the need to cut it out. As discussed early on, cutting should be done along the construction lines. The utility knife is used in cutting so as to have very sharp edges as well as avoid injuries. The researcher cut out the shapes after practicing the art of cutti9ng over a period so as to be able to have sharp cuts especially along curves. A steel rule was used as guide when straight lines had to be cut. This was done by placing it on the drawing to avoid accidentally cutting through the design. This ensures that the design is not cut through, should the blade slip. If that happens, the blade cuts through the waste paper instead.

For safety reasons, the researcher ensured that his non-cutting hand was kept away from his cutting hand.

Figure 3.4: A knife held in the standard position for cutting

Scoring

This is the art of making creases in the paper so as to fold easier. Folding involves compressing the card along a marked line. During scoring, the researcher used the wrong side of the utility knife to compress the fold line by using pressure, guided by the steel rule. There was the need to ensure a relatively firm pressure on the knife so as not to mistakenly cut along the fold line.

Figure 3.5: Scoring with the wrong edge of a utility knife

Folding

After scoring, the next stage is folding. This is done along the scored lines using the hand or folding sticks.

Figure 3.6: Folding

Gluing

The researcher used the glue stick since it is easier to use and makes makes the structure neater.

Figure 3.7: Gluing

Technical Considerations

When creasing for folds in solid board, the crease should be on the outside of the planned fold line, that is, the fold folds away from the crease. However, for folds in corrugated board the crease (or score) should be on the inside of the fold .

In many cases, the direction of the grain of the material- or corrugated board - is important. the green/fluting can affect the quality of a crease and the overall stability of a package. It is best to discuss this with materials suppliers and manufacturers before completing a design.

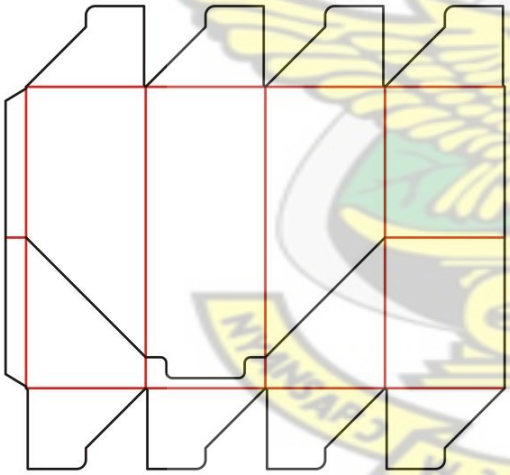
The surface of the material used is an important issue to consider when choosing the type and quality of printing and finishing. For example, rough board is not suitable for fine or high-contrast graphics whereas high-quality paperboard or corrugated board (with at least one smooth, coated face) allows for high standards of offset printing, foil stamping and embossing.

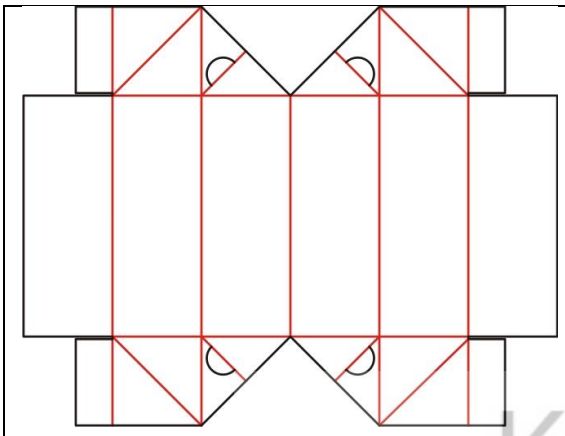
Plotters and Laser Cutters

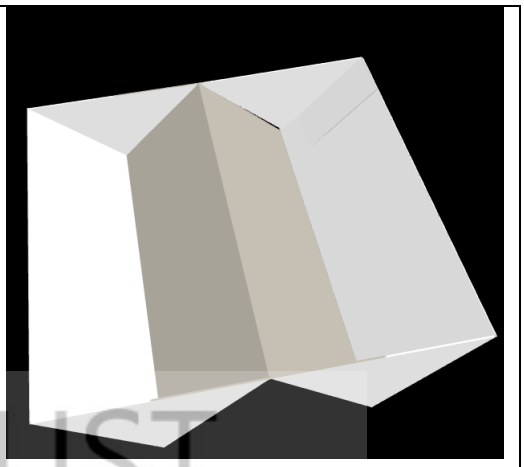
Plotters and laser cutters are equipment used in cutting out shapes for mass-produced packages. In using the plotter, the drawing pen is replaced with a knife to do the cutting. Laser Cutters are also useful for production runs, but come into their own for cutting intricate detail into card. The level of detail they can create is extraordinary. The drawbacks with laser cutters are that they can be expensive to use and that they can leave unsightly brown scorch marks along cut edges.

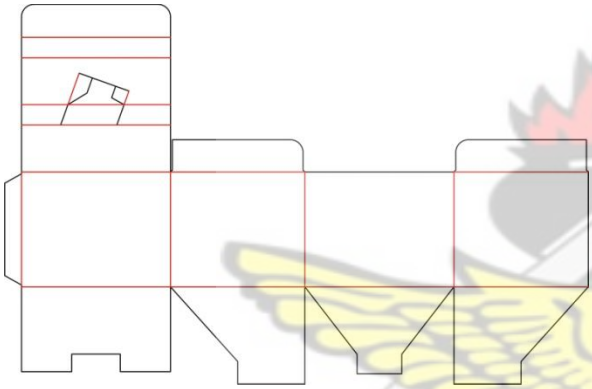
Samples of Packaging Structures and their construction lines

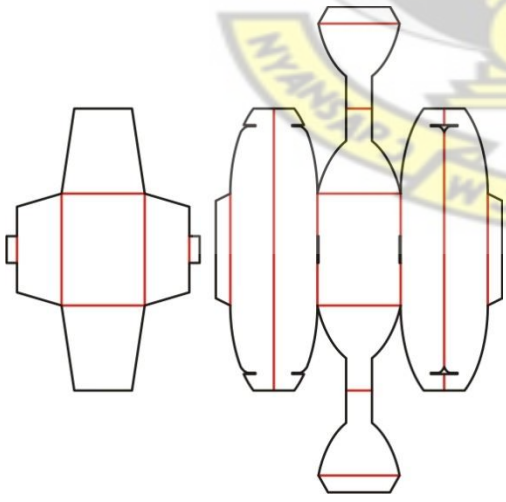
Display Packages

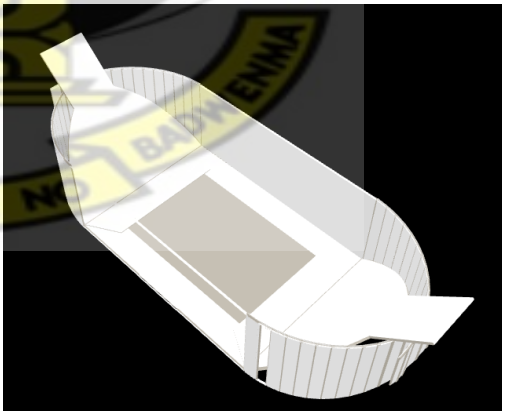
Construction Line	Package Structure
	

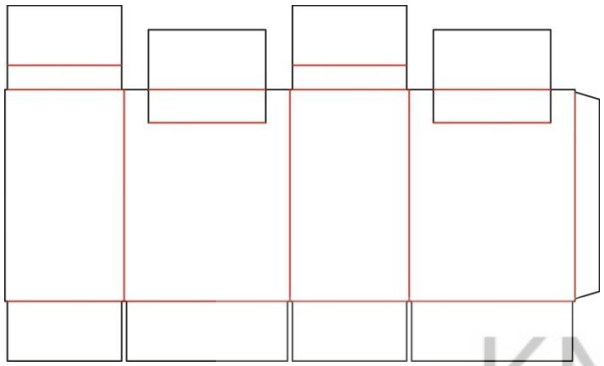


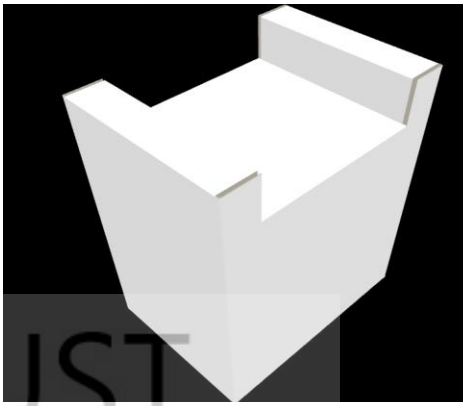


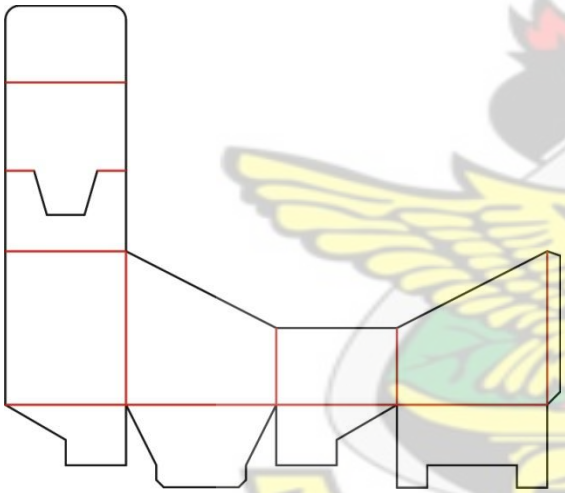


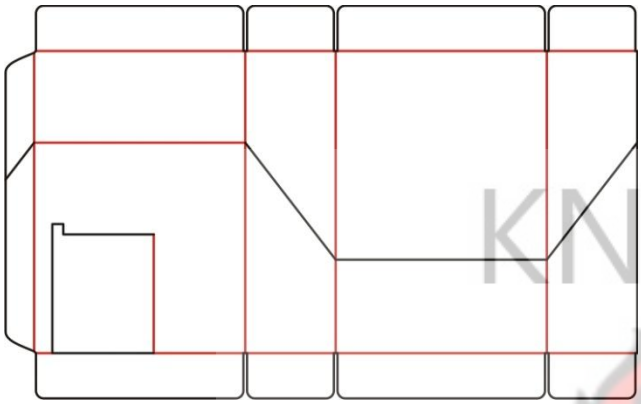












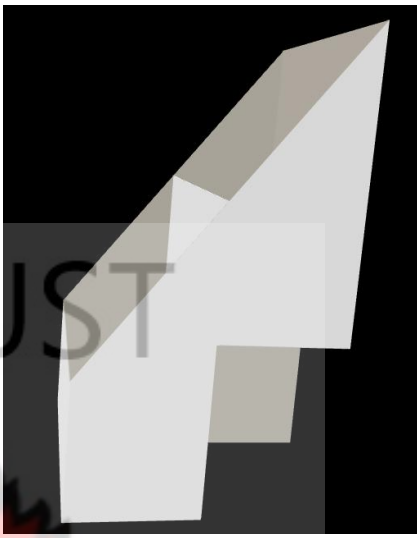
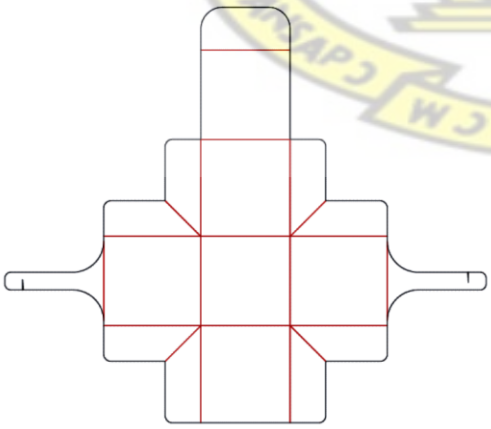
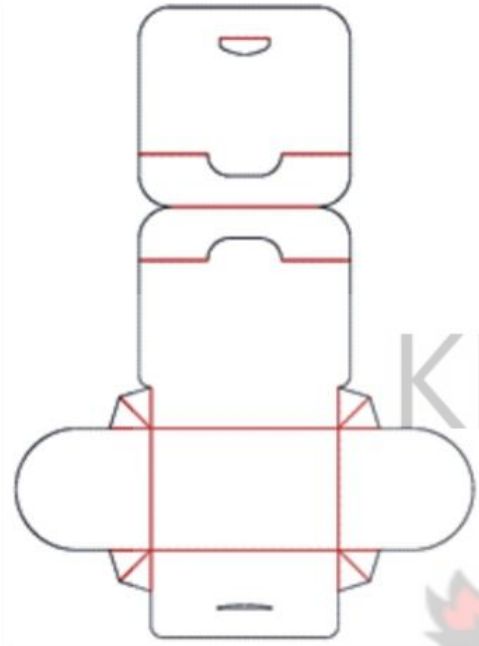
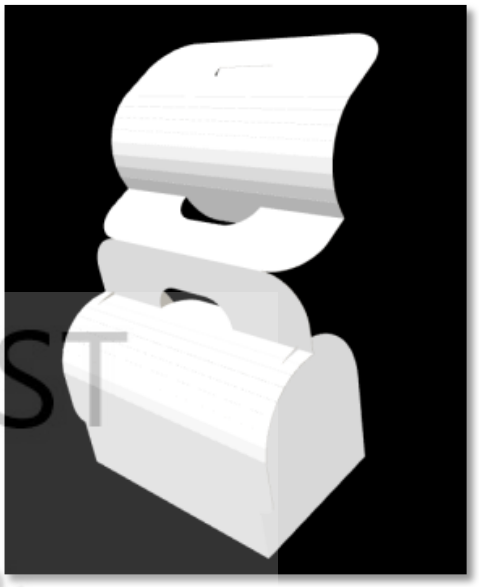


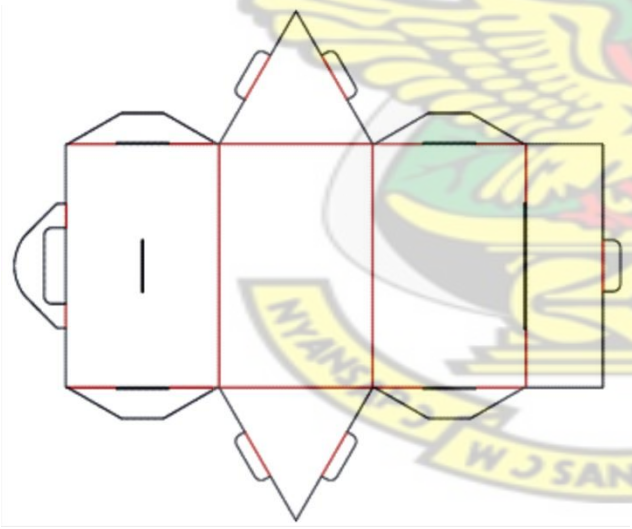
Figure 3.8: Construction lines of Display Packaging Structures

Carriers

Construction Line	Package Structure
	







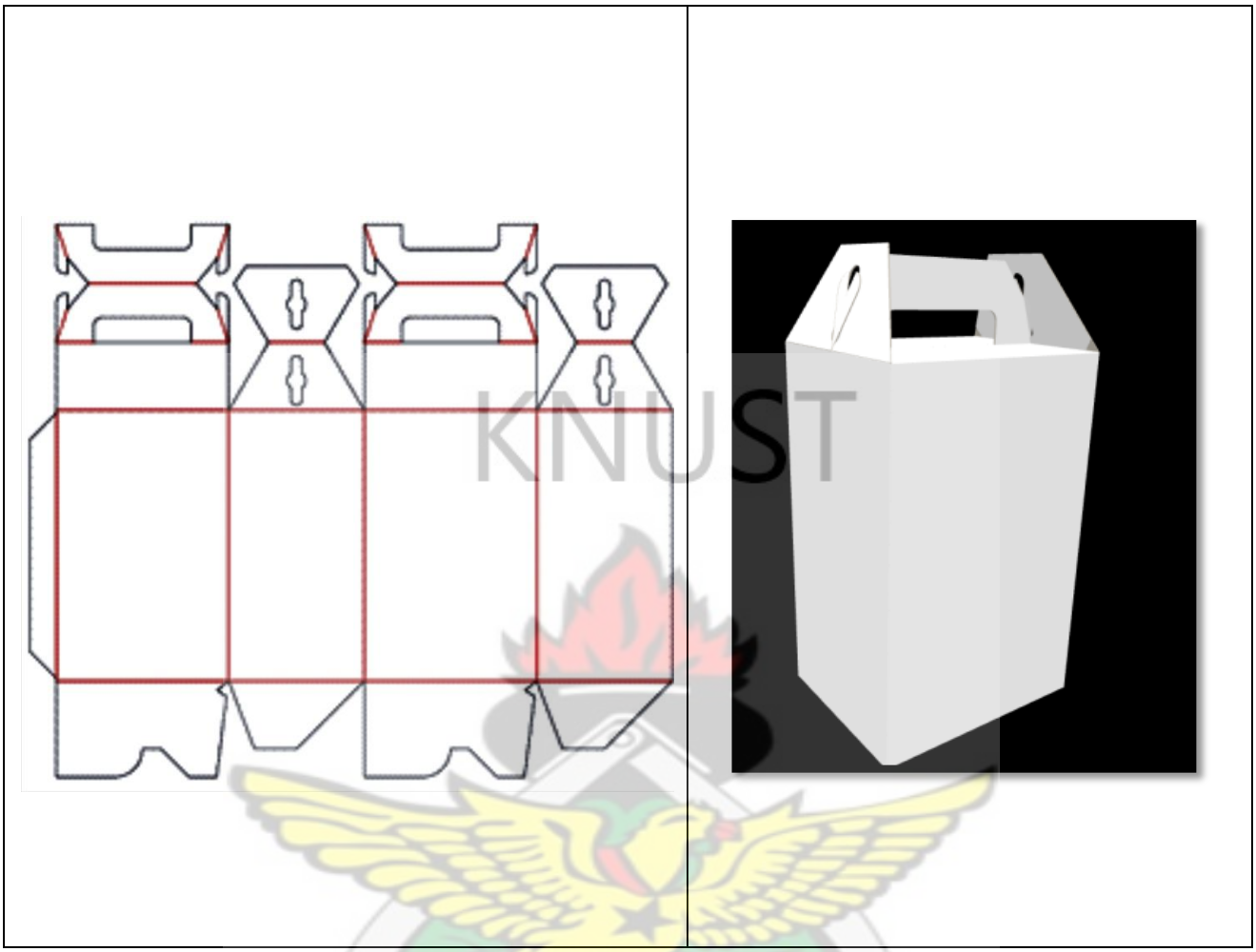
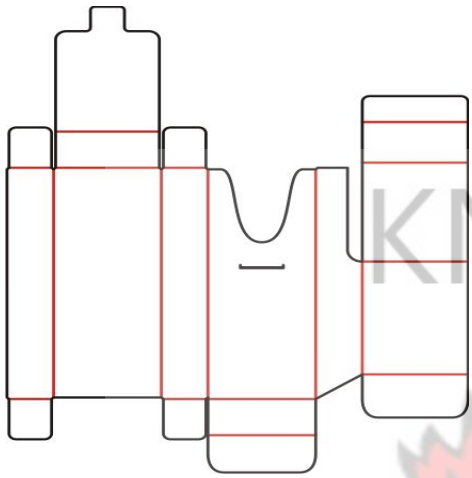
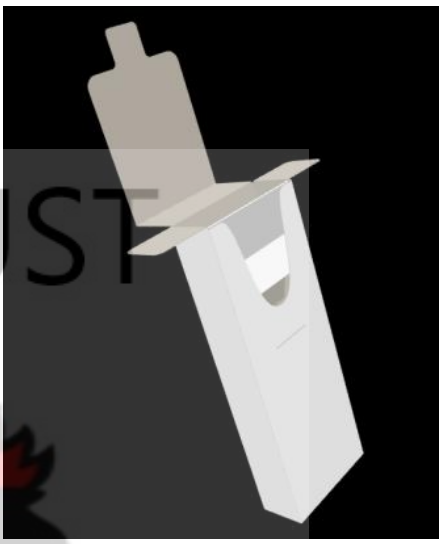
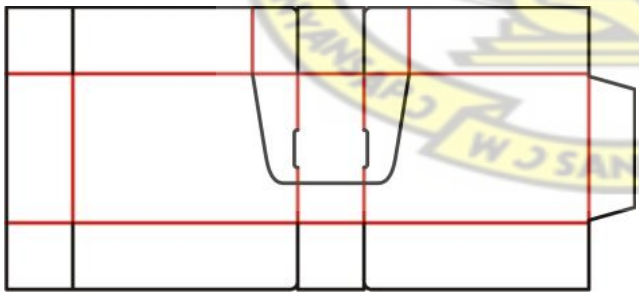
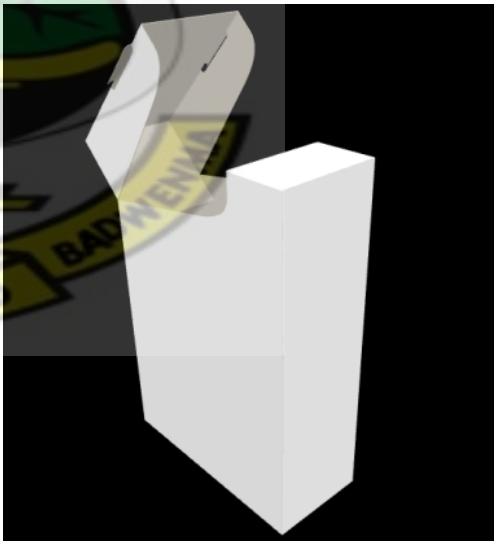


Figure 3.9: Construction lines of Carrier Packaging Structures

Dispensers

Construction Line	Package Structure
	
	

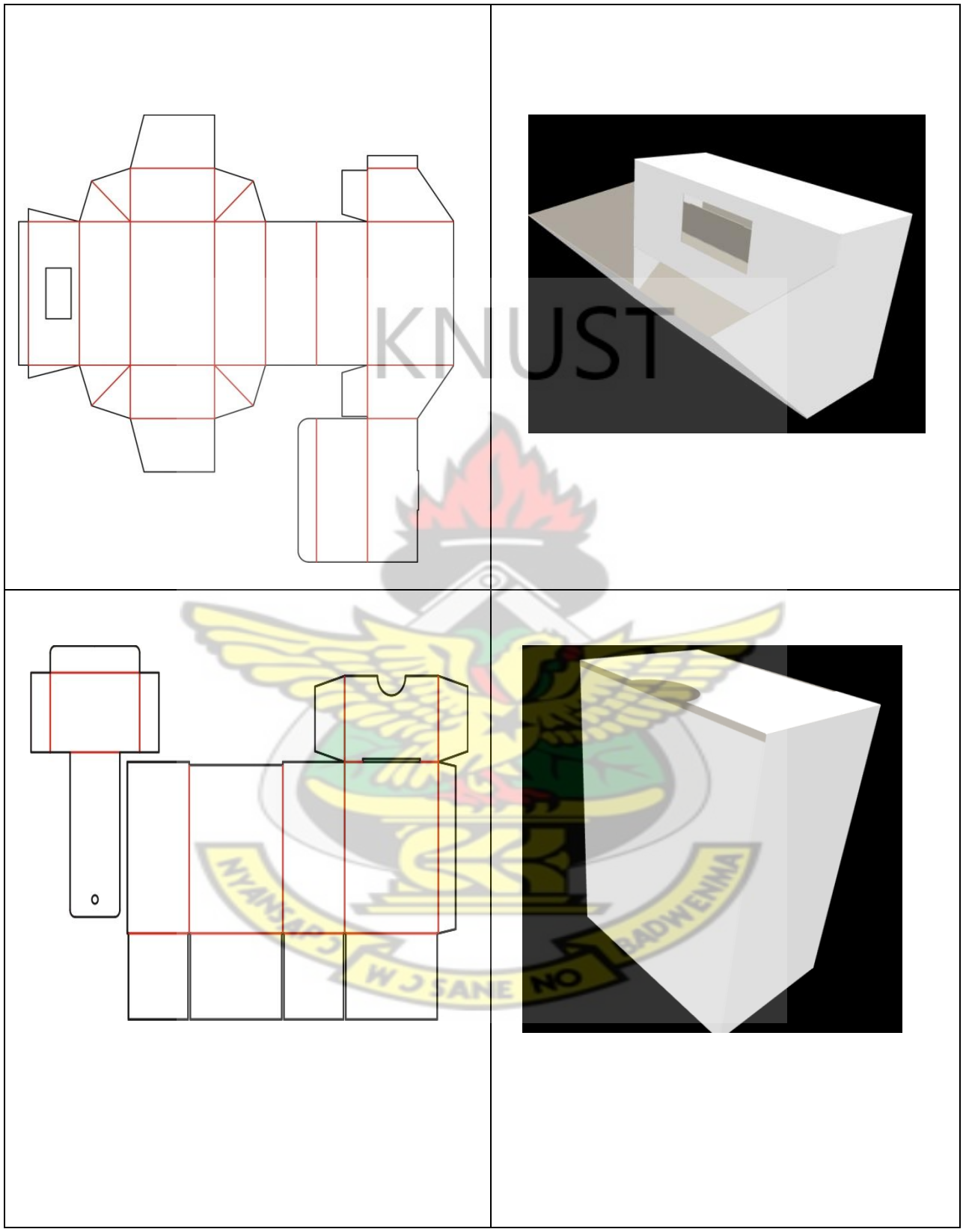
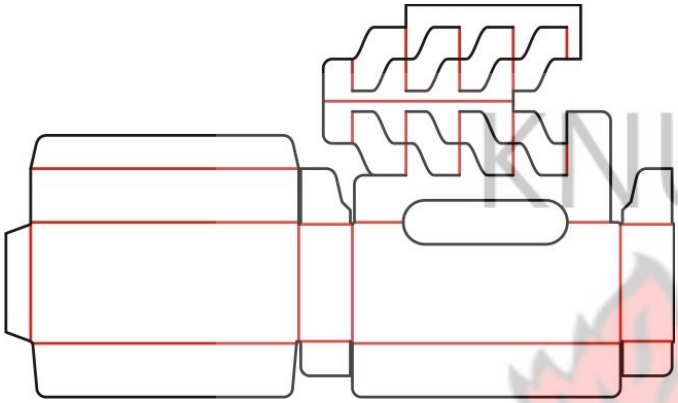
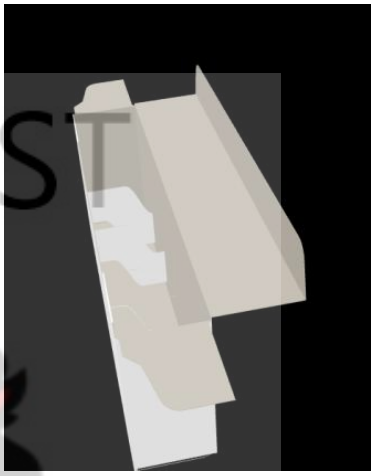
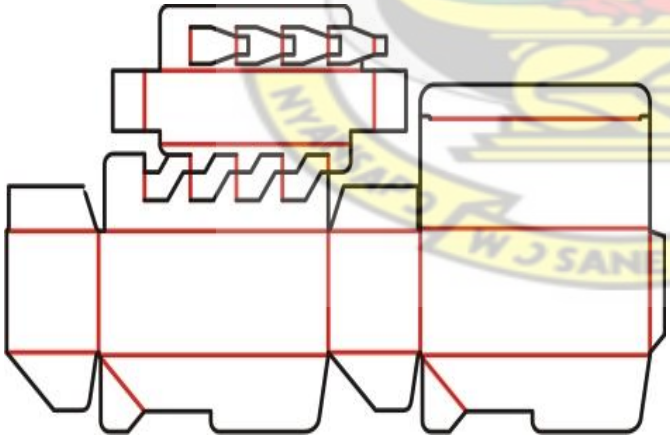
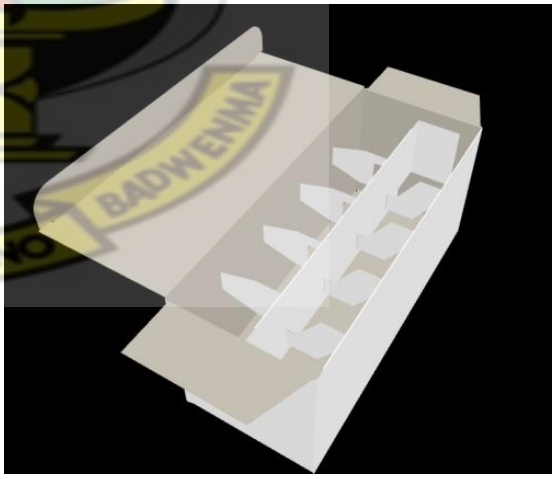


Figure 3.10: Construction lines of Dispenser Packaging Structures

Dividers

Construction Line	Package Structure
	
	

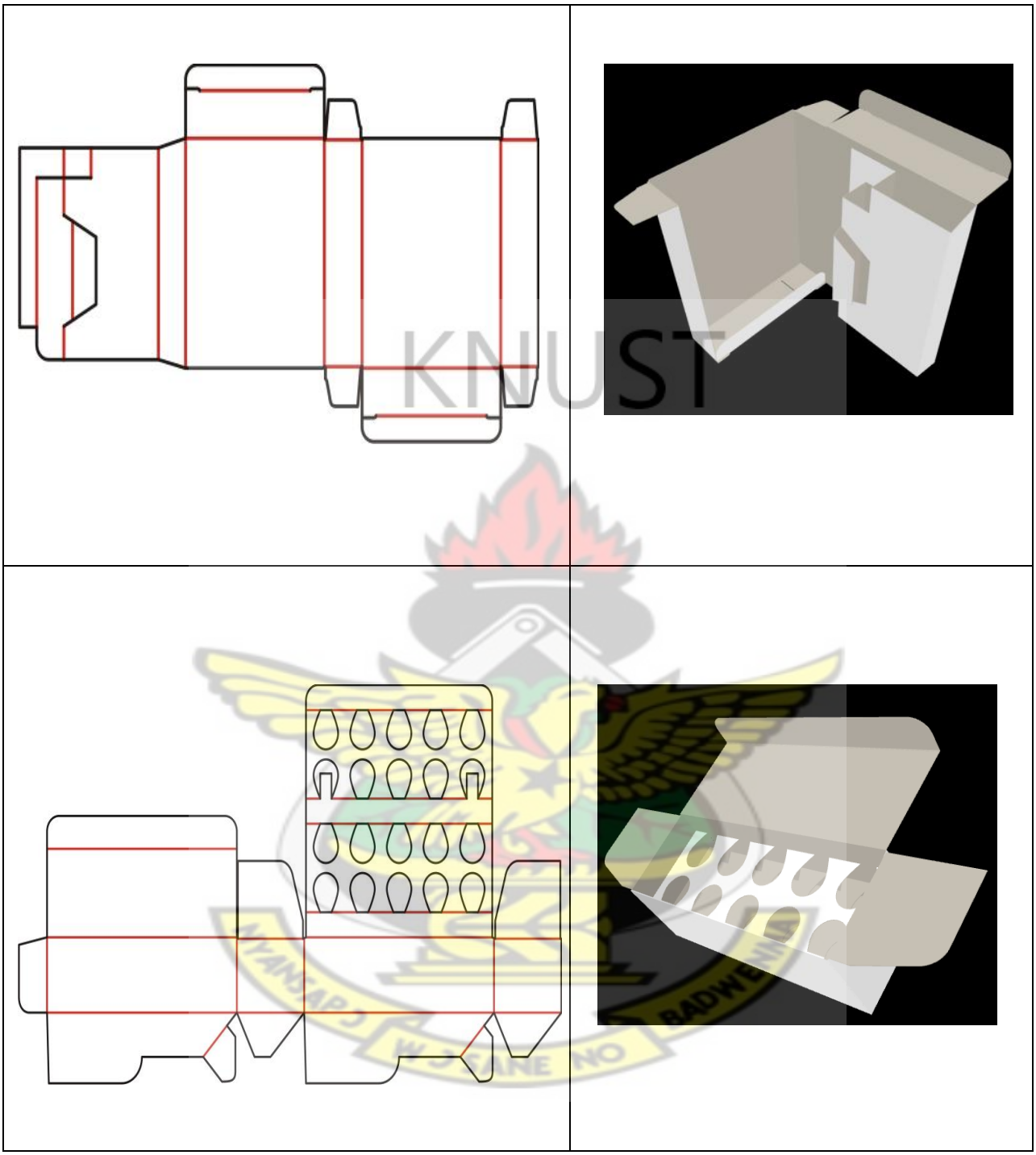


Figure 3.11: Construction lines of Divider Packaging Structures

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

Overview

The focus of this chapter is on the analysis of data gathered from the field with the aid of questionnaires involving over eighty (80) respondents. It concentrates on the actual research findings and discusses data on the concept of standout in packaging through structural designs**.** It discusses and analyses the opportunities and prospects of packaging structures in Ghana from the viewpoint of consumers, manufacturers and shopping mall operators as was obtained from the field survey. All these analyses were guided by the statement of the problem, the research questions and study objectives as stated in chapter one of this study.

The profiles and functions of the key institutions consulted for the research are presented. For the consumers and shop operators, data gathered and presented includes factors that account for low patronage of locally made products, their various behaviours regarding their packaging structures and challenges associated with the current state of packaging of locally made products. Also, the challenges in the local packaging industry regarding their structures are discussed. Packaging materials that can be used to creatively package local products and some innovative shapes into which the structure of local packages could be made also discussed. In all, two sets of questionnaire were analysed; one set for consumers and the other questionnaire was for shopping malls, supermarkets and mart operators and manufacturers.

Categorisation of Respondents

In analysing the data, respondents with homogeneous characteristics were put together to enable the researcher easily do the data analysis. For instance, respondents from institutions such as supermarkets, marts and small scale enterprises were grouped together, separately from the manufacturers, consumers and all other stakeholders in the packaging industry such as The Institute of Packaging Ghana (IOPG), The Ghana Standards Authority, The Food and Drugs Authority, The Plastic Industries (Danica Plastics, Poly Group, etc.) and The Aboso Glass Factory.

Some elite in society, as well as students of the Kwame Nkrumah University of Science and Technology

were also contacted. The age groups were also considered. For example, these were categorized into 13-19, 20-39, 40-59 and 60 and above.

PRESENTATION AND INTERPRETATION OF DATA FROM INTERVIEWS CONDUCTED

Data gathered from the questionnaires designed for the packaging design sector revealed that 55.0% of the respondents consider it unnecessary the look of the structural packaging of their products. They maintained that it is the content of the product they are concerned with and not the packaging structure. This had to do more especially with pharmaceuticals, both local and international. 40%, however, were of the view that the structural design of a product is very essential to the marketability of their products and therefore sought the assistance of the researcher in that regard. 5.0% of the people interviewed were indifferent on the issue. They were of the opinion that a product, be it packaged or not was not an issue to them, and that they

will be attracted to good structures anyway. Reasons given by those who answered "No" to the question related to lack of understanding of packaging structures, financial constraints, failure to consult packaging design experts, it being unnecessary and their unwillingness to invest more into quality packaging with emphasis on structures. The researcher also considers these reasons given by the designers as constraints to local manufacturer's efforts in developing good packaging structures for their products. The two most popular explanations given by 65% of the population were about the manufacturers' fear of high cost of good quality packaging, especially considering the price of their products in the eyes of their customers. The statement by Judd *et al* (1989) is therefore confirmed about packaging for the local market. They observed that manufacturers producing for their local market do not attach much importance to their packaging because they are mostly known by their customers and they may enjoy the monopoly market situation.

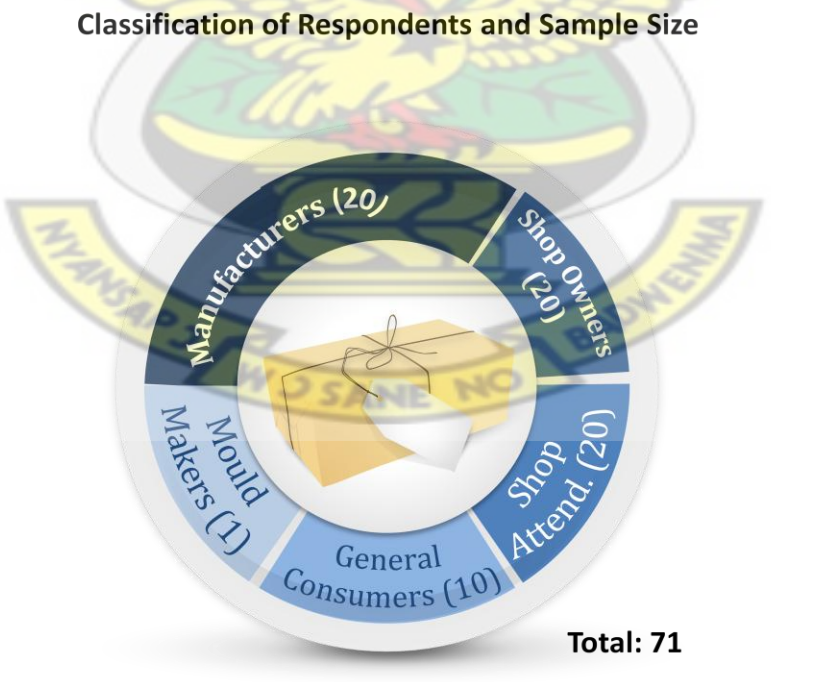


Figure 4.1: Classification of Respondents and Sample size

Figure 4.2: Results from Respondents on the need for good Structural Packages

Results from Shopping Mall Owners and Supervisors

Open ended questions posed to shopping mall operators during the research process on their perceptions and experiences on the impact the structural look of the packages of their products have on their consumers with regard to patronage of the products and their profits as well as strategies to improve the structure of the packages of the products, especially the locally made products. This is due to the fact that these shops are the means by which manufactured products, both local and imported, get to the final consumer. A total of about 20 supervisors or managers of shopping malls were sampled.

Data regarding shop owners and supervisors were on areas such as: *What effects the look or structural design of the package has on consumers?* That is, whether the structural design of

their products have any effects on the consumers' patronage for those products, and *What accounts for the rejection of some of their products by both sellers and consumers.*

It was realised, based on the research conducted, that most of the locally made products, to some extent, are not well packaged. Also the packages were uninteresting, and had poor finishes. As a result, patronage for locally made products was low compared to the imported products. It was, however, found that the elderly cared less about the package of the products, be they locally made or imported and that it was the youth who were much concerned about the package of the products and therefore were attracted by very well packaged products, especially as regards their structures.

Poor Structural Packaging

The packaging materials used and the way the structures are designed and sealed were found to be the most contributing factors of poor packaging. In some cases, local manufacturers were found to be trying very hard to work on the structures of their packages, using good quality materials and well-trained Graphic Designers. The problem, however, had to do with the finishes such as sealing and packing. This is an area where the manufacturers lacked the expertise and technical abilities, thus leading to poorly-finished packages. It is therefore very important that more care be taken in packing and handling of products as regards their packaging so as to ensure proper sealing and packing to maintain the integrity of their packages and thus increase the patronage for their products. This is because a very good package makes the product more believable and may even cause consumers to buy the products on impulse.

The Location of Shops and its effects on sales

Many shop operators were of the view that no matter the look of the packaging structure, once the location is good for business, the product sells. A conscious effort was therefore made to sample shop operators using the main roads in Kumasi as the guide. This was aimed at improving on the scientific nature of the research. A total of 20 respondents were contacted from 18 shops malls and shops at Adum, the commercial hub of Kumasi, with the highest number of shops. Also, because Adum is the central business district of Kumasi, all manner of people do their shopping there. The working class usually does their shopping in Adum most because of proximity.

This research revealed that the least group of people who patronize goods from shopping malls is student. This is owing to the fact that they find items sold there expensive. Though the research suggests that students are attracted to products by the structural design and graphics, because most of them do not work, they are not able to patronise these products. Interestingly, the research revealed that most often, many students who go to the supermarkets and shopping malls only go there for window shopping; thus they only go there to have a look at the products, especially pre-tertiary students. The working class, however, tend to purchase more frequently from the shops.

KEY ORGANIZATIONS VISITED

The Institute of Packaging, Ghana (IOPG)

The Institute of Packaging, Ghana (IOPG) is a non-profit-making organization formed in 2004. IOPG is devoted to the development and promotion of packaging in Ghana. IOPG represents the interests of its members in the packaging industry. It strives to achieve this through various activities such as workshops, seminars and conferences.

IOPG maintains strong links with local and overseas packaging organizations and is a full member of the World Packaging Organization

The objectives of IOPG are:

- To inform the public of the benefits to be derived from effective packaging
- To educate people in all matters relating to packaging
- To promote the status of packaging and the interests of members in the field by every appropriate means
- To establish such educational standards, examinations, bursaries and qualifications as may seem appropriate for the promotion of packaging
- To publish and disseminate educational and training information about all matters which relate to packaging.
- To hold conferences, exhibitions, seminars and other functions calculated to promote the interest of packaging
- To affiliate or to associate with any person or body having common interests and objectives with those of the Institute
- To encourage research and development in packaging
- To serve as a forum for discussion and exchange of knowledge between persons interested in packaging

Activities

The Institute of Packaging, Ghana (IOPG) has spearheaded many projects aimed at strengthening the capacity of local manufacturers and other stakeholders in the packaging industry in order to bring them up to international standards. They have sponsored many Ghanaian local converters

for further training and exposed them to advanced packaging technology in countries like Thailand, India and the European Union.

The Ghana Standards Authority

Formerly the Ghana Standards Board, The Ghana Standards Authority (GSA) which is a statutory body with overarching responsibility for establishing quality standards and specifications for raw and packing materials as well as finished products, was established by the Standards Decree, 1967 (NLCD 199) which has been superseded by the Standards Decree, 1973 (NRCD 173). The Authority is also the custodian of the Weights and Measures Decree (NRCD 326, 1975). These legislations together mandate the Authority to undertake:

1. National Standards development and dissemination;
2. Testing Services;
3. Inspection Activities
4. Product certification scheme
5. Calibration, Verification and Inspection of Weights, Measures and Weighing and Measuring Instruments
6. Pattern approval of new weighing and measuring instruments
7. Destination Inspection of imported High Risk goods
8. Promoting Quality Management Systems in Industry
9. Advise the Ministry of Trade and Industry, on standards and related issues

In a discussion with the Public Relations Officer, Mr. Kofi Amponsah Bediako, he stated that the authority handles consumer complaints on product defects, expiry dates and standardization of

packaging for dangerous goods for export and the local market. In line with the commitment of the Ghana Standards Authority to assist Ghanaian manufacturers, industrialists and service providers to be competitive and acquainted with international standards on the global market, they organize technical training programmes for the manufacturing industry.

The Ghana Standards Authority issues licenses to manufacturers for all new products.

Once approved, the manufacturer is issued with a certificate and permitted to print the GSA logo on the packaging of the licensed product as a seal of quality. A certificate authorising the use of the GSA mark is renewable annually.

The mission of the GSA is to promote standardization for the improvement of the quality of goods, services and sound management practices in industries and public institutions in Ghana. Their vision is to become a model of excellence in Standardization in Africa.

The Food and Drugs Authority (FDA)

The Food and Drugs Authority (FDA) was established by the Food and Drugs Law 1992, PNDCL 305B. This law has since been amended by the Food and Drugs (Amendment) Act 523, 1996 to provide for the fortification of salt to alleviate nutritional deficiencies and to bring the provisions of the law in conformity with the 1992 constitution, and provide for related issues.

Before 1990, the control of drugs and the practice of pharmacy profession was under the Pharmacy and Drugs Act 64, 1961. In 1990, the Provisional National Defence Council (PNDC) passed the Narcotics Drug Control, Enforcement and Sanctions Law , PNDCL 236. This law established the Narcotics Control Board to deal with the rising incidence of drug abuse in the country and the threatening dimensions that illicit drug dealing had taken internationally. In

1992, the PNDC separated the control of drugs other than narcotics from the practice of Pharmacy.

The Food and Drugs Law 1992, PNDCL 305B was then enacted to control the manufacture, importation, exportation, distribution, use and advertisement of food, drugs, cosmetics, chemical substances and medical devices. Consequently in 1992, the PNDC separated the control of drugs from the practice of pharmacy. The Pharmacy Act 489, 1994 was subsequently passed in 1994 to establish the Pharmacy Council to regulate the practice of the Pharmacy profession and the registration of Pharmacists in Ghana. Although the Food and Drugs Law was passed in 1992, it was not until August 26, 1997 that the Board was inaugurated. The Food and Drugs Board is under the control and supervision of the Minister responsible for Health.

Challenges facing the Local Packaging Industry (structure-wise)

From this study, about 55% of local manufacturers do not really see the need for any special attention to the structure of the packages. Those who expressed interest, however, did not know of experts in packaging structures to assist them in that respect. Manufacturers are not ready to incur additional cost of production since they complain of low profits due to cheap imports of similar products from China, India, Malaysia, Thailand, South Africa, The Far East, Nigeria and Europe.

Another challenge identified was the capital intensive nature of the industry which demands modern, automated equipment for large scale production. Ghana's packaging sector is dominated by small-scale enterprises, engaged in the production of plastic, paper and paper board. The absence of a glass manufacturing industry such as the now defunct Aboso Glass Factory is also a challenge to the industry since all glass packages are in the country are either imported from

Nigeria and South Africa. The local packaging industry ifs further challenged by the increased demand in packaging owing to such factors as the trend towards smaller households, the increasing requirements for convenience among consumers, the rising health awarenesss among consumers; the trend toward 'on-the-go' lifestyles among the increasing time-poor consumers; growing requirements for brand enhancement and differentiation in an increasingly competitive environment; new packaging material development; the move towards smaller pack sizes as the incidence of families eating together at the dinner table becomes less common and increasing awareness of environmental issues. These factors, coupled with the exposure of the Ghanaian middle-class to high quality packaging that has shifted the demand towards well-packaged, clearly labeled and environmentally friendly products.

It was also noted that the liberalization of trade in Ghana led to foreign manufacturers of packaging entering the local market and producing relatively more attractive packaging at affordable prices. This has led to the patronage of packages from these new entrants increase while packaging produced by local manufacturers has not seen similar growth.

Many consumers complained about the usual use of the plastic bag (popularly referred to as polythene bag) for packaging almost all our local products, especially food. They complained of very embarrassing experiences they had when the plastic bag used to package food they had bought got torn in public and poured onto the ground.

Materials that can be used to creatively package local products to improve their patronage

Materials such as glass, paper, wood, plastic and metal can all be used in designing interesting packaging structures. In Ghana, however, plastic and paper packaging are the common leading

materials used on the local market, constituting 40% and 25% respectively. Metal constitutes 15%, glass 10%, wood crates and pallets 5% and jute and cotton 5%.

In Ghana, since plastic and paper are commonly used, they could be creatively designed into beautiful structural packages for our local products. For the purposes of this study, the researcher used paper for the suggested packages. This is because paper is biodegradable and can be easily recycled, compared to plastic. Also paper can be easily manipulated without heavy equipment and therefore less capital intensive.

The Impact of Packaging Structures on Product Sales

From the study, more than three quarters of all purchase decisions are made in-store and in a matter of seconds. Structural packaging plays a crucial role in emotionalising purchase decisions among target groups. More than being simply a protective carrier of information, packaging communicates the advantages and essence of the product. The combination of brand specific-design elements and functional innovations strengthen the brand's message. Systematic design allows for increased brand recognition and optimised handling, as well as supporting strategic product line structuring.

The potential promotional effect of shape or structure of a package is not always understood by the marketing people in charge of packaging development and design. A distinctive package shape provides a good opportunity to reinforce the brand image of the product. The three-dimensional feature of packaging (structure) can in many instances give important additional support to the brand message, primarily communicated to the customer by packaging graphics.

Some examples of packages that have used shape as an important part of the product imagery:

1. The Coca Cola bottle, designed in 1915, one of the best known of all packaging shapes, has stood the test of time and up till date, its attractive shape has contributed in giving it a powerful brand, thus its patronage always very high.
2. Similarly, the Pepsi Cola bottle, designed in 1950.
3. The many distinctive shapes for Scotch whiskies such as Johnny Walker
4. The Heinz bottle for ketchup and other condiments, among many others.

Figure 4.13: The development of the Coca Cola bottle since 1899

The shape features of these packages are used to indicate the type of product it contains. The most common examples are the three main types of wine bottles: necked for Bordeaux wines, sloping shoulders for Burgundy wines (Eastern France) and elliptical flasks for Franken wines from Germany and Matteus rose wine from Portugal.

The use of shape as a branding element is very effective in glass packaging design. This is however restricted by the high cost of moulds for producing glass bottles and jars. Plastic packaging has in principle the design features and opportunities of glass but is more versatile and much less expensive to form. Paperboard cartons can also be formed in various forms and proportions to a certain degree.

The shape concept could include distinctive technical construction details which can be used to reinforce the brand image and make the product and its package unique in relation to those of the competitors. Examples are the small screw caps on juice cartons, the metal pouring spouts on some containers and the re-closing feature of the small cartons for cough syrups.

INNOVATIVE STRUCTURAL PACKAGING SUGGESTIONS

Suggested Package for 'Ahenema' (Native sandals) Alata Samina

Roasted Groundnuts (Nkate bowie) Prekese

Kente

Chewing Stick (Sokoduaa)

Tiger nut (Atadwe)

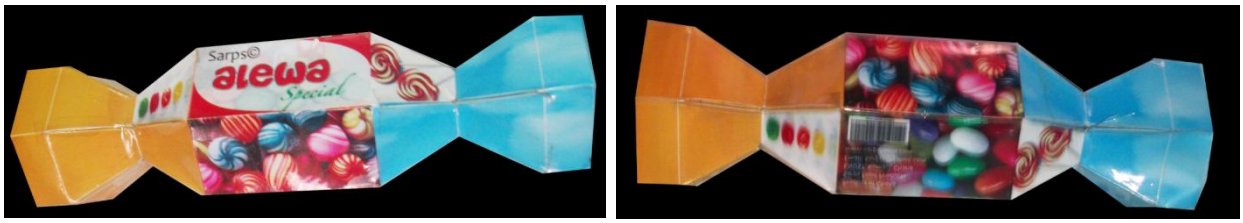
Powdered pepper

Plantain Chips

Azumah Blow soap

Pop Corn

Nkate Cake



Alewa Toffees

Dough nut (Puff puff) Soya beans

Wood Carving (mask) Banana

Fig. 4.14: Suggested Packages

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter presents a summary of the research and conclusions that were drawn from the study. A summary of recommendations proposed to help improve the image and identity of Ghanaian made products with regard to their structural packaging so as to gain both local and international acceptance and patronage.

5.2 Summary

This research sought to explore the Concept of standout in packaging structures as well as the opportunities and prospects of Ghanaian products. Based on this topic, the objectives were to:

1. Identify materials that could be used in packaging structures such as paper, glass and plastic
2. Assess the impact of the packaging structures on product sales.
3. Design and create sample packaging structures.

Shopping malls, shop owners, general consumers and the students of KNUST as a case study, copies of questionnaires were administered to packaging-related institutions in Ghana and the group of people mentioned above within the Kumasi metropolis.

The analysis of field data revealed that many consumers (about 65%) do not patronize made-in-Ghana products because they are not attractive enough, both graphically and structurally. This however, excludes drugs which they patronize based on their efficacy. Also, manufacturers are hindered by the cost of engaging the right professionals to design their packages and hence fall on the cheap non-professionals.

Also, institutions such as the IOPG, FDA, GSA, FAGE, among others mandated to implement the existing but inadequate laws on labelling and packaging are faced with many challenges and hence, products with no user information and therefore below required standards, are found on the market.

From the above discussion so far, there is enough proof that the packaging industry in Ghana needs to lift up its game to ensure that Made-in-Ghana products make the necessary economic impact on the lives of our people through good packaging (graphically and structure-wise), that will compete well on the international market, in addition to the good quality nature of the product.

5.3 Conclusion

The focus of this research was to explore the concept of standout in packaging with respect to structures and make implementable recommendations aimed at improving the packaging industry in Ghana.

This research was carried out at a time when local manufacturers are struggling with the issue of patronage of their products, resulting in dwindling sales and the consumer also complaining of relatively poorly done packages.

Various state institutions such as FDA and the GSA as well as private organizations such as AGI, PEF and IOPG are also trying frantically to deal with the issues above. Hence, the relevance of this study cannot be over emphasized. The analysis was in four different parts, namely, Shopping malls, shop owners, general consumers and manufacturers. The analysis of

the consumers confirmed that to a very large extent purchasing decisions are mostly made at the point of sale and that the aesthetic value (Structure and graphics) and the adequacy of information provided on the label of the product are key influencing factors in choosing which product to purchase. Shop owners also confirmed this assertion and stressed that the packaging (structure and graphics) of many Made-in-Ghana products fall below standards comparing them with their foreign counterparts. Some manufacturers, on the other hand, in their bid to maximising profits, ignore the issue of proper packaging, afraid of the cost they may incur and the available market. The institutions that were visited all showed some level of inadequate capacity, though they have been given more power to properly prosecute their agenda. For instance, the Ghana Standards Board (GSB) is now the Ghana Standards Authority (GSA), likewise the Food and Drugs Board (FDB), now Food and Drugs Authority (FDA).

These authorities must ensure that all existing laws on packaging and labelling are strictly adhered to and respected to ensure that the right professionals are employed to package the products in a way to attract the local consumer, else they would continue to struggle with reduction in sales.

5.4 Recommendations

The laws on packaging in Ghana that established the Ghana Standards Authority and the Food and Drugs Authority, among others in the packaging industry basically dealt with labelling. It is not so detailed to deter people who violate it. For instance, it could be detailed to include the dos and don'ts in packaging, as well as encourage manufacturers to take a good look at the structures of their packages. The Institute of Packaging Ghana (IOPG), The Federation of Ghanaian Exporters (FAGE), the Ghana Export Promotions Council, The Association of Ghana Industries

(AGI) in collaboration with the Ministry of Trade and Industry all other stakeholder organizations should periodically hold packaging seminars for all stakeholders in the industry to educate them on current trends, do's and don'ts of the industry as well as start present papers to the Government and lobby from all appropriate quarters for the formulation of packaging laws well-tailored towards improving made-in-Ghana products to meet international standards. This will contribute tremendous to the development of our economy since the manufacturing industry is a great contributor to every economy.

Secondly, frantic efforts must be made by the government of the day to renovate and re-establish a packaging company like the Aboso Glass Factory which totally ceased production in 1998, rendering many, hitherto, gainfully employed people jobless. The researcher's visit to the factory site at Aboso, near Tarkwa in the western region revealed that the raw material for glass production are readily available in the region in abundance and it would not cost so much in getting it. It is basically silica (white sand). This will save the indigenes of Aboso and the whole of the western region and Ghana as a whole by providing employment to the youth most of whom are engaged in illegal mining popularly referred to as 'galamsey' which is killing many of them as many of the pits dug indiscriminately collapse on these young men and women. The activities of these galamsey operators is destroying the environment to the extent that even the fertility of the soil is being lost to their activities. The re-establishment of the glass factory, the researcher believes, would help curb all these problems facing the nation. The collapse of the Aboso Glass Factory means that all glass in the country is imported, mostly from Nigeria and South Africa, which means that the country loses foreign exchange.

Thirdly, knowledge about the existence of the Act establishing the Food and Drugs Authority and The Ghana Standards Authority which deal with labeling and standards is very scanty among the general public. It was so surprising that even manufacturers who are expected to know of its existence and work with it were not aware.

Also the centralized nature of the FDA and the inadequate budgetary support from Government, must be addressed. The FDA must be decentralised to district levels so as to get to the grass roots.

Finally, to be able to improve upon the structural designs of our locally made products, a course such as Product Design could be introduced in our tertiary institutions such as KNUST and the polytechnics, using Computer Aided Design (CAD) software such as Cape Pack and Artios CAD to help improve upon our structural designs to meet world standards.

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APPENDIX 1

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND SOCIAL SCIENCES

DEPARTMENT OF COMMUNICATION DESIGN

This Questionnaire is designed to help the researcher, a graduate student of the Kwame Nkrumah University of Science and Technology, Kumasi into the topic: Exploring the concept of standout in structural packaging: Prospects and opportunities in Ghana. Your confidentiality is assured. Thank you.

1. QUESTIONNAIRE FOR CONSUMERS
2. Sex: Male ( ) Female ( ) 2. Age ( )
3. Occupation……..……
4. Educational level

   a) Elementary School [ ] b) Secondary School [ ] c) Teacher Training College [ ]

   d) Technical/Vocational School [ ] d) University [ ] e) No Schooling f) Other (Specify)

   ……
5. From which of the following do you normally buy?

   a) Shopping Malls ( ) b) Local Market ( ) c) Street Traders ( ) d) Anywhere convenient ( )

   e) Other (specify)……
6. What are your opinions on the packages of locally manufactured products?

   a) Excellent ( ) b) Good ( ) c) Bad ( ) d) Average ( ) e) Very Bad ( )
7. What in your opinion accounts for the bad impression about the packaging of locally made Ghanaian products?

a) Illiteracy ( ) b) Apathy on the part of consumers c) Lack of education of manufacturers ( ) d) Others (specify)

.....

8. What will make you buy a particular product from the shelf?

a) Beautiful Structural Packaging ( ) b) Need for the product ( ) c) Packaging providing the needed information ( ) d) Manufacturing and Expiry Dates ( ) e) Content of the Product ( ) f) Others (specify)……

9. Is your purchasing decision influenced by the attractiveness of the package?

Yes ( ) No ( )

10. If yes, how? ……

……

11. If no, why?

……

12. Which of the following influences your purchasing decision of a new product most often?

a) The graphics (Colour and design) ( ) b) The structure or shape ( ) c) Both ( ) d) The need for the product

13. Which of the following do you normally buy?

a) Made in Ghana Products ( ) b) The Foreign products ( ) c) Both

(i) Why? ……

14. What are your impressions of packaging of foreign products?

a) Well Packaged ( ) b) Protects the products very well ( )

b) Provides all the needed information ( ) d) Others (specify)……

15. What will make you prefer a foreign product to its local counterpart?

a) Package design ( ) b) The product itself ( ) c) The Prestige Associated with the product ( ) d) The Structural design or look of the package ( ) e) Others (please specify).....

16. What are your impressions of packaging of locally manufactured products?

a) Not attractive enough ( ) b) Poorly finished ( ) c) Inadequate information provided ( ) e) Does not reflect Ghanaian culture ( )

17. What improvements do you want to see in the packaging of Ghanaian products especially as regards their structure?

……

……

18. Which locally-made products would you want to see repackaged or properly packaged? Name as many as possible.

……

……

……

Thank you very much for your time.

APPENDIX 2

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND SOCIAL SCIENCES

DEPARTMENT OF COMMUNICATION DESIGN

This Questionnaire/Interview Guide is designed to help the researcher, a graduate student of the Kwame Nkrumah University of Science and Technology, Kumasi into the topic: Exploring the concept of standout in structural packaging: Prospects and opportunities in Ghana. Your confidentiality is assured. Thank you.

QUESTIONNAIRE FOR INSTITUTE OF PACKAGING GHANA (IOPG)

1. Name: ……..
2. Position: ……..
3. What is the role of the institution in the promotion of made in Ghana products?

   ……
4. What are the challenges facing the institution regarding packaging?
5. What is the state of the packaging industry in Ghana with regard to their structures?

   a) Not attractive ( ) b) Poorly finished ( ) c) Inadequate information provided ( ) e) Does not reflect Ghanaian culture ( )
6. Are there any rules regarding packaging Ghana?

   Yes ( ) No ( )
7. To what extent do manufacturers adhere to these rules if any?

   a) Strictly ( ) b) Fairly ( ) c) Care less ( ) e) Ignorance ( ) (f) Others

   (please specify) …….....

8. Are there any sanctions for manufacturers who flout these rules these?

   Yes ( ) No ( )

9. What are these sanctions (if any)?

   ……

10. What are the advantages of good packaging structures?

    (a) Exportable ( ) (b) Increased patronage ( ) (c) Competitive ( ) (d) Others

    (please specify) ……..……

11. In your opinion, which locally made products do you find improperly packaged?

    ……

12. What attempts are being made at addressing the issue of inappropriate local packages?

    ……

13. To what extent is packaging promoting made in Ghana products?

    a) To a very large extent ( ) b) Fairly ( ) c) ( ) (f) Others (please specify)

    ……

14. What are the challenges facing the institution in undertaking its duties?

    ……

15. What possible solution can be adopted to solve these problems?

    ……

    ……

    ……

    Thank you for your time and cooperation

APPENDIX 3

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND SOCIAL SCIENCES

DEPARTMENT OF COMMUNICATION DESIGN

This Questionnaire/interview guide is designed to help the researcher, a graduate student of the Kwame Nkrumah University of Science and Technology, Kumasi into the topic: Exploring the concept of standout in structural packaging: Prospects and opportunities in Ghana. Your confidentiality is assured. Thank you.

QUESTIONNAIRE/ INTERVIEW GUIDE FOR GHANA AUTHORITY AND THE FOOD AND DRUGS AUTHORITY

Name of respondent ……..

Position of respondent ……

1. What is your institution doing to ensure that standards are met, as regards packaging of made in Ghana

   goods……...

2. What accounts for the relatively poorly packaged locally made products?

(a) Lack of education for manufacturers (b) High illiteracy rate among consumers (c) Lack of skill on the part of packaging (d) Others (please specify)

……

3. Please can you give instances of inappropriate packaging and what was done about it?

……

……

4. What are the advantages of good packaging?

……

……..

5. Please can you give some examples of inappropriate packaging?

……..

6. What have you done about these inappropriate packaging?

……

……

……

7. To what extent is packaging promoting made in Ghana products?

……

……

8. How can the packaging of Made-in-Ghana products be improved?

……

……

……

Thank you.

APPENDIX 3

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND SOCIAL SCIENCES

DEPARTMENT OF COMMUNICATION DESIGN

This Questionnaire is designed to help the researcher, a graduate student of the Kwame Nkrumah University of Science and Technology, Kumasi into the topic: Exploring the concept of standout in structural packaging: Prospects and opportunities in Ghana. Your confidentiality is assured. Thank you.

QUESTIONNAIRE FOR SHOPPING MALLS OPERATORS AND ATTENDANTS

1. Name of shop?.....

2. Location of shop?.....

3. Types of products sold

a) Provisions ( ) b) Cosmetics ( ) c) Confectionaries ( ) d) Toiletries ( )

e) Alcoholic Beverages ( ) f) Cereals ( )

4. Which class of frequently buy from here?

a) Working Class ( ) b) All classes ( ) c) Students ( ) d) Others ( )

5. How often do you take stock?

a) After sales everyday ( ) b) Every weekend ( )

c) Once a month ( ) d) Quarterly ( ) e) Bi annual ( ) f) Annually ( )

6. Do you have any considerations as to the packaging of your products before stocking them

Yes ( ) No ( ) Not Really ( )

7. Which of the following do you look out for in stocking your shop with made in Ghana products with regard to their packaging?

I. Exposed Product Content

II. Expiry date

III. Production date

IV. Storage/care instructions

V. Labels that are fading

VI. Lid that is not tight

VII. Leaking containers

VIII. Rusting on containers

8. From your experience, to what extent does the structural packaging of a product determine the purchasing decision of consumers?

a) Very large extent ( ) b) Some extent ( ) c) Not considered ( ) d) Do not know ( )

9. What are the differences between the packaging of foreign products and their Locally made counterparts as regards their packaging?

……

10. What are your impressions of packaging of locally manufactured products?

b) Not attractive ( ) b) Poor Finishes ( ) c) Inadequate information provided ( )

e) Does not reflect Ghanaian culture ( )

11. Has there ever been an instance where a poorly packaged product has been Rejected by consumers? a) Yes ( ) b) No ( )

12. If yes, what is the product? …….....

13. If yes, what was the reaction of the consumer?

b) Disappointment ( ) b) Got Annoyed ( ) c) Asked for Reasons ( )

d) Asked for refund of money ( ) e) Did not take back the product ( )

f) Blamed the manufacturers ( ) g) Others (specify)……

14. What was wrong with the packaging?

b) Product contents were exposed ( ) b) No expiry date ( )

c) No information on usage ( ) d) Package was faded ( )

e) Product had expired ( ) f) Others (specify)……

15. What are some of the reasons for the low patronage of Made-in-Ghana product?

a) Exposed Product Content ( ) b) Lack of expiring date ( )

c) Labels that are fading ( ) d) Lids that are not tight ( )

e) Leaking containers ( )

16. What do you think can be done to increase the patronage of Made-in-Ghana products?

……

……

Thank you.

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