A REVIEW OF SOME PACKAGING MATERIALS/TECHNIQUES USED IN GHANA

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ABSTRACT

Packaging is and has become a tremendous tool for marketing in these present times. Almost all goods are packed in one form or the other on purchase. However, the degree and extent to which packaging is carried out varies from nation to nation depending on the level of development, the level of industrialisation and the culture of the people. Packaging in Ghana is still at its developmental stages however, it is carried out at both the small-scale and the large-scale industrial levels. This involves different packaging techniques ranging from the use of leaves, paper, cardboard, glass, plastics, wood, metal to that of aluminium foil. The packaging industry is not devoid of problems, these problems range from environmental hazards to waste management. This paper thus reviews the various packaging techniques used in Ghana including the sources of the materials, areas of use, advantages and disadvantages of the technique, problems associated with the industry and recommendations.

INTRODUCTION

Man has lived always finding an ease as to how to contain his articles and protect or preserve them. This can be traced back to ancient man's settlement from hunting and farming. Early man used leaves for wrapping purposes and animal hide as the first flexible packaging material in the transport of water and wine (IheKoronye and Ngoddy, 1985). Most of the early methods used are similar to those used in the modern world. Civilisation created the awareness as to the containment of goods and these were the gradual beginnings of packaging. Today, packaging is a tremendous improvement on its humble beginning in the ancient world because it has become a tool for marketing (Kotler, 1985). In present times almost all goods (both consumables and non-consumables) are packed in one form or the other on purchase. The degree and extent to which packaging is carried out varies from nation to nation depending on the level of development, the economic and industrial base of the nation and the culture of the populace. For example, in the United States of America, statistics show that about 400 billion packages are used annually. This total includes 62 billion metal cans, 35 billion glass bottles, 7 billion plastic bottles and others including cardboard cartons and boxes, plastic bags, cups and wrappings, metal foils and metal drums. Japan follows next in order, followed by Europe (Leonard, 1974). In Ghana, like other West African countries, the packaging industry is not as highly developed as that of the developed nations thus information on packaging techniques in terms of statistics is not easily available. This article reviews the current state of information on packaging techniques used in Ghana including the sources of the material, areas of use, advantages and disadvantages of the techniques and the problems associated with packaging as well as some recommendations to solve some of the problems.

PACKAGING AND ITS FUNCTIONS

Packaging has become very important in the battle for consumer hearts and minds. The emphasis on packaging throughout food marketing clearly suggests a trend that will intensify in the coming years (Hollingworth, 1996). Thus, packaging in present times plays a significant role in production. However, the perception of packaging varies from industry to industry depending on what is being packaged. For example in a textile industry, packaging is just a means of easy transport but in a food manufacturing or cosmetic industry, the package also serves as the main tool for marketing.

Packaging has been defined in a number of ways. Kotler (1985) defined it as the activities of designing and producing the container or wrapper for a product. Bram *et al.* (1983) defined it as the industrial and marketing technique for containing, protecting, identifying and facilitating the sale and distribution of agricultural, industrial and consumer products. However, one definition which well describes packaging in Ghana is that of the Packaging Institute International (Anon. 1988). They defined packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container forms to perform one or more of the following functions; containment, protection, and/or preservation, communication and utility or performance. Therefore, if the device performs one or more of these functions it is considered a package.

The containment function of a package involves the package containing and facilitating handling, transportation, storage and distribution all the way from the manufacturer to the ultimate users. The protection and preservation function of a package are against mechanical, chemical, environmental and biological hazards (Packaging Code, 1989). Utilisation of packaging as a medium for communication has gained great dimensions in the manufacturing sector. It is basically used to identify the product and its origin, to inform the consumer on the utilisation of the package contents, to provide any other information needed and encourage consumers to increase their purchases.

Modern industrialised societies have brought along with it tremendous changes in life styles, and the packaging industry has had to respond to these changes. Some of the

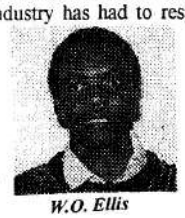

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Table 1

List of Companies showing the type of products produced and the packaging materials used.

COMPANY	PRODUCT	TYPE OF PACKAGE
Astek, Gh.Ltd.	Fruit drinks	Bottles & Tetrapak containers
Cadbury, Gh. Ltd.	Beverages and confectionery	Plastic containers, cellophane films, cardboard cartons
Danafco	Pharmaceuticals	Plastics, films and containers, paper, bottles, wooden containers, cardboard cartons.
Fan Milk Gh. Ltd.	Dairy products	Plastics films and containers, foils, cardboard cartons
Ghana Food Distribution Corp.	Agricultural products (cereals).	Jute sacks, polysacs
GHACEM Gh. Ltd.	Cement products	Paper
Ghana Sanyo Ltd.	Electronics	Plastic films. cardboard cartons
GIHOC paints Ltd.	Paints	Metal/plastic containers
Ghana Textiles Manufacturing. Company (GTMC)	Textiles	Paper, Kalico
Irani Brothers Ltd.	Flour	Cotton bags, plastic containers, cardboard cartons
Johnson Wax Ltd.	Insecticides, disinfectants	Metal cans, plastic containers, cardboard cartons
Lever Brothers Gh. Ltd.	Cooking oil, toothpaste detergents, margarine, etc.	Foil, paper, plastics containers.
Lube Oil Gh. Ltd.	Lubricants	Metal drums, cardboard cartons, plastic containers
Schwepps	Soft drinks	Bottles, papers, wooden cartons

changes are the high demand for a variety of food and drinks at outdoor functions, fast food chains, restaurants, etc. Thus packaging also plays a role in allowing products to be used conveniently (Robertson. 1992; Griffin *et al.* 1985). Examples of convenient packages used in Ghana are the tetrapak containers for fruit juices used by Astek Ghana Limited, plastic pouches (or films) for spirits (Totapak) by Paramount Distilleries Company, fermented and non-fermented dairy products such as Fanyogo and Fanmilk by Fanmilk Ghana Limited. The tetrapak containers used by Astek Ghana Limited for their fruit juices is the first of its kind in the country. It is very convenient for the user and relatively cheap, thus its acceptability and sudden increase in sales (Kudzodzi, 1993).

Generally, a distinction is made between the various levels of packaging. These levels can be classified into four groups; primary, secondary, tertiary and quaternary packages.

(i) A primary package is a package in direct contact with the contained product, eg. Metal cans.

(ii) A secondary package is one which contains a number of primary packages, eg. cardboard box containing bottled products.

(iii) Tertiary package is made up of a number of secondary packages, eg. shrink wrapped fruit juices and

(iv) Quaternary package is frequently used to facilitate the handling of tertiary packages, eg. Metal containers up to 12m in length (Robertson, 1992).

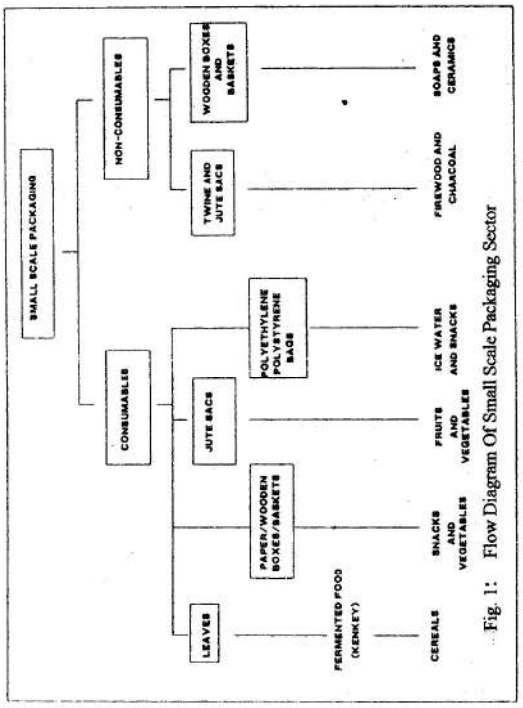

Fig. 1: Flow Diagram Of Small Scale Packaging Sector

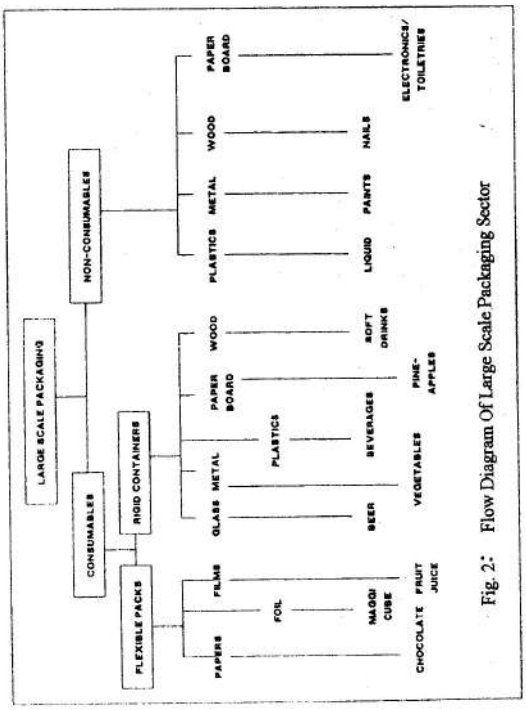

Fig. 2: Flow Diagram Of Large Scale Packaging Sector

PACKAGING TECHNIQUES USED IN GHANA

Packaging in Ghana is still at its developmental stages. Some of the techniques in use involve the application of leaves, papers, metal containers, jute sacks, plastics, wooden containers, etc. Table 1 shows some of the companies in Ghana, the type of products packaged and the type of packaging materials used.

In Ghana, the packaging industry can be grouped into two on account of the industrial base of the nation. These groups are (i) the small scale packaging and (ii) the large scale packaging industries. The type of packaging technique in use depends on the type of industry and product produced, i.e. whether consumables or non-consumables. In the large scale industries, both flexible and rigid packaging materials are used in the consumable goods sector whereas most of the non-consumable goods require rigid containers. Figures 1 and 2 show simple set-ups for small scale and large scale packaging including the types of packaging materials used and some examples of products packaged in these materials. The general techniques used in Ghana involve:

a. **Application of leaves** - Leaves form a part of the staple food industry. They are commonly used for wrapping fermented maize products such as kenkey and cereal based foods like rice, beans, "waakye", etc. The source of the leaves are mainly from sheaths of corn cobs, plantain leaves and "Awonomo" (leaves of *Thaumatococcus daneilli*). These packaging materials aim at providing shape, containment and

convenience in terms of handling. In certain situations, leaves are considered to offer partial protection through dropping or material loss (accidental). The advantages of using this technique is the ready availability of packaging material and the cost of utilisation. However, the disadvantages involved in using this type of packaging are (i) the introduction of contaminants from the package due to the unhygienic nature of these leaves, (ii) the high level of material loss through the following processes: water vapour loss causing drying of some food products with time, loss of oils and fats from greasy foods and the loss of volatile flavour components from the foods. The leaves are also unable to protect the contents of the package from shocks, vibrations, compressive forces or microorganisms.

b. **Paper packaging** - There are many types of papers used for food packaging. In Ghana, there are mainly the treated paper and the plain paper. The treated paper are of different types. Paper packaging aims mainly at containment, protection and convenience. In the small scale sector, both treated and plain papers are used mainly for containment such as the wrapping of food products, eg. spices, tomatoes, cereals, baked products, confectionaries, etc. In the medium and large scale industries treated papers are used for dry foods such as flour, dried fruit, green grocery, fats, baked goods and confectionary. Plain paper is not heat sealable and therefore finds fewer applications. Most of the paper used in the packaging industry is obtained from used newsprints, which is presently having a big market in the country. Currently large amounts of used newsprints are imported from Europe into the country for sale with the sole aim of being used as packaging materials. Other papers come from used textbooks and exercise books, printing sheets and brown paper. In the medium and large scale industries, most of the papers used are imported for the packaging of specific products. Wax treated paper offer good barrier to air and moisture. Paper packaging in general has the advantage of being readily available and cheaper. However, it has several disadvantages and these include the following;

(i) Contamination of contents by ink from newsprints and used exercise books especially fatty foods. Some of these inks may be carcinogenic and thus may be dangerous to health.

(ii) All papers are sensitive to changes in environmental humidity and temperature of the environment. This has a corresponding effect on the contents of the package during storage.

(iii) Paper has the limitation of not being able to protect contents of package against insects and rodents.

(iv) There is also the loss of oils and fats from greasy foods and some treated papers are also very expensive.

(v) Paper also contributes greatly to environmental waste.

c. **Wood and Cardboard packaging** - Wooden boxes and cardboard cartons are obtained from wood and wood pulp respectively. They play a significant role in the packaging industry in Ghana due to their cost effectiveness. They are used both in the small and large scale industries for packaging of products such as soaps, ceramics, beer, electronic materials and a whole lot of other non-consumable goods. This form of packaging is also used in the food industries for export products such as pineapples, citrus fruits, spices and vegetables. The main functions of this form of packaging are to offer containment, protection and convenience especially in the area of transportation. These materials have the advantage of being reusable and readily available thereby making it a very cost effective packaging technique. They provide better protection against mechanical damage such as crushing, puncturing and vibration. However, the wooden boxes offer better protection than the cardboard cartons. They can both be made into different sizes and thickness for the packaging of specific products. Examples are the different corrugated boards with different flute sizes used in cardboard boxes. Irrespective of these advantages, they have certain limitations such as cost. It is very expensive to produce and it adds extra weight to the products. As a material, wood is porous and so does not offer a better barrier to moisture and air (Fellows and Axtell, 1993).

d. **Metal packaging** - This involves the use of metal containers. There are various types of metal containers used in the food industry. Some of the common ones include steel drums, tins with push-on or screw-on closures, sanitary cans (the "tine" can), composite cans (combination of paper board and steel), aluminium cans and aluminium dishes, etc. Metal containers are from steel, tin or aluminium. Cans still form a greater percentage of common rigid containers used in the packaging industry. They are mainly used for packaging and preserving food products such as fruit juices, tomatoes, meats, fish, vegetables and dried products such as spices. The steel drums are used for packaging high value products such as paints, lubricants, petroleum products, vegetable oils, chemical solvents and others. Aluminium cans and dishes are mostly used in the small and medium scale packaging industries mainly for containment. The main functions of metal packaging are to offer containment, protection, and convenience especially in the area of transportation. The steel drums are mainly used for bulk movement of products especially liquid products. Metal containers also serve (or are used) as medium of communication. For example, many canned products have attractive labels on them and these have great promotional and customer appeal. In Ghana, packaging using metal containers especially metal cans is mainly carried out by large scale and some medium scale industries. However,most of the raw materials are imported. Another packaging technique in this category involves the use of aluminium foils. These foils are inert and offer excellent barrier to air, moisture, light and microorganisms, however, they are expensive and not reusable (Fellows and Axtell, 1993). It is used as a primary package for confectionary products, condiments and food sensitive to light and air. Examples are Maggi cubes, Royco cubes, chocolates, etc. This form of packaging has several advantages such as being tamperproof, giving total protection against light and air, offering convenience, especially storage at ambient temperature. Most metal containers especially the bigger types such as the drums are reusable in one form or the other. The application of cans has certain distinct advantages which includes good heat transmission thereby enabling effective sterilisation and pasteurisation of some can products, lighter in weight, resistance to physical damage and imperviousness to light and air. One obvious disadvantage in using this form of packaging is cost. The high cost of metals and relatively high manufacturing cost makes this form of packaging very expensive compared to other forms. Most metal containers

are quite heavy and therefore add to transportation cost.

The other major disadvantage is that the contents of the container cannot be seen by the purchaser.

e. **Glass packaging** - Glass packing forms a greater proportion of the Ghanaian packaging industry (about 40%). Glass is basically made from quartz sand, calcinated soda, limestone and broken glasses (UNIDO, 1969). This form of packaging is used in the medium and large scale industries and to a certain extent in the small scale industries for the packaging of various products. Glass containers come in different shapes and sizes which in turn has a bearing on the function of the package. Some of these packages are in the form of bottles, jars, jugs, tumblers, vials and ampoules. In Ghana as well as other countries, glass packaging is widely applied in food processing for the packaging of natural and artificial juices, beverages, beer, wine, processed fruits and vegetables (UNIDO, 1969). Glass packaging is also employed locally in the cosmetic and pharmaceutical industries. This technique involves packaging the product into appropriate package and sealing using requisite closure, either screw-on or pull-on cap or heat sealing especially in the case of the ampoules. Depending on the type of product, product may be pasteurized or sterilised for preservation and onward distribution. The packaging process may in certain cases involve pressure and gas packaging (carbonation). Example of these are beer and soft drink production. These require carbonation using carbon dioxide under pressure.

This form of packaging like the others aims at providing containment, protection against mechanical damage, insects and rodents, microorganisms, gases and moisture. It also offers convenience in terms of handling, transportation and storage. It serves as a means of advertisement and increases consumer appeal and acceptability. This form of packaging has several advantages due to the nature of the packaging material. Glass is chemically inert and does not react with the food material. It is strong, reusable and recyclable. These factors seem to offer a wide variety of applications in the Ghanaian packaging industry. It is impermeable to gases and moisture and serves as a good barrier to microbes, insects and rodents. Due to the ability of some glass packages to withstand heat, they can be heat pasteurized depending on the product, to offer longer shelf life. These advantages notwithstanding, there are certain limitations such as the fragile nature of glass as well as the weight which it adds to the total weight of the packaged product. Furthermore, it is expensive to produce glass packages (Robertson, 1992).

f. **Plastic packaging** - Plastic packaging has become a complex market worldwide and there are a wide range of these packages. The application of plastic packaging forms about 30% of the packaging industry in Ghana. However, this figure keeps increasing due to the advancement in packaging technology. These plastic packages can be grouped into two; (a) rigid plastic packages consisting of bottles, jars, tubes, cups and trays, and (b) flexible plastic packages consisting of the flexible films. With the exception of cellulose, all plastics are made from crude petroleum products and because of the number of finite properties which they possess, they can be adjusted to special needs by suitable choice and combination of materials (UNIDO, 1969). Due to cost of production, plastic packages are gradually replacing glass and metal packages for food packaging on the world food market, however in the Ghanaian food sector, glass packages still predominate relative to the others.

A range of plastics and co-polymers are used in the manufacture of plastic packages. In most developing countries such as Ghana, the common materials used are polypropylene, polythene, polyvinylchloride (PVC) and polyethylene tetraphthalate (PET) (Fellows and Axtell, 1993). Plastic packaging plays a significant role in both the small, medium and large scale packaging industries and they involve a wide variety of products, both consumables and non-consumables. For example, plastic bottles are used for non-alcoholic beverages, some chemical solvents, pharmaceutical syrups, artificial fruit juices, cooling oils (frytol), dairy products (pure countre milk) and others. Jars are used for peanut butter and creams, trays and tubs are used for butter, fats, ice creams, jams and cocoa butter. Cups are used for packaging liquid products. Similar to glass packaging, plastic packaging using rigid packages involves packaging product into container sometimes using the appropriate plastic lid. Under certain conditions, the final product is heat pasteurized especially diary products.

Plastic packaging involving the use of flexible films is gaining wide application in the manufacturing sector (both small scale and large scale). This may be due to the lower cost involved in this form of packaging, the lightness of the material, availability of the package and the convenience in terms of handling. Such flexible films are used for the packaging of bakery products, spices, fruits and vegetables, snacks, creams and ice water. Currently, its application in the ice water industry has increased tremendously due to improvements in production and packaging technology. The flexible plastic films are used as primary packages in the packing of cocoa powder, dairy products such as Fan ice cream, Fan Yogo and Fan Spot and shrinkwraps for products such as Refresh fruit juices. Flexible film packaging involves various techniques such as vacuum packaging and gas packaging. The efficiency of this type of packaging depends to a very large extent on the type and properties of the packaging film as well as the packaging environment.

This type of packaging has the advantages of reduced cost due to lighter weight which reduces transport cost. They have attractive appearances, are cheaper to manufacture compared to other like glass, aids advertisement because they can be easily printed on to inform customers. In addition, they have good barrier properties against moisture and air, they are squeezable due to their lightness and they are able to protect and extend the shelf life of some food products when the appropriate type of plastic package is selected. The major problem with the plastics is that most of them are not biodegradable and therefore pose an environmental hazard. In Ghana, it is not possible to recycle most of these packages, especially the flexible packages and this is a serious limitation.

There are other packaging techniques which involve the use of materials such as jute sacks, baskets and cloth. Jute sacks made from plant fibre such as "kenaf", form a large proportion of the packaging materials used in the small-scale sector and in the rural areas. They are used for the packaging of agricultural products such as fruits and vegetables, dried fish and in the plant fuel industry for firewood and charcoal. They are cheap and readily available. It does not offer

effective protection to food crops against enzymatic spoilage. spoilage by microorganisms and insects. Baskets have played a very significant role in the Ghanaian packaging sector and they have been in use for so many years. They are used mostly in the rural areas and to a lesser extent in the urban areas due to the raw material source. They are involved in the efficient packaging of agricultural produce both for transit and storage, this helps to limit the degree of post-harvest losses in the farming communities (Adegoroye *et al.*, 1990). Baskets are made from the rachis of palm fronds (Elaeis guineensis Jacq.) and are used in the packaging of fruits and vegetables (Abbot, 1970), cassava, plantains, snails, fresh and dried fish, charcoal and others. The use of cloth is one of the oldest forms of packaging and it is still in use in certain sectors of manufacturing such as the flourmills.

Depending on the type of product being packaged and the intended shelf life, some of these forms of packaging utilise either vacuum packaging or some form of gas packaging. Vacuum packaging is a technique which is already in use in Ghana and its application is on the increase due to the changing needs of the society. It is strictly a form of Modified Atmosphere Packaging (MAP) (Elworthy *et al.*, 1989). It can simply be defined as the packing of a product in a high barrier package from which air is removed to prevent growth of aerobic spoilage organisms, shrinkage, oxidation and colour deterioration (Genigeorgis, 1985). This technique is used in the plastic packaging of several food products, examples are meat products which are now becoming a regular feature at some of our big shopping malls such as Multistores, A-life Supermarket stores, etc. The disadvantage of this technique is its dependency to a very large extent on the type of package selected. It does not also limit the growth of anaerobic microorganisms. The form of gas packaging in use in Ghana is mostly that of carbonation and this is mainly done in the brewery and soft drink industries. The gas used is carbon dioxide.

Even though the packaging industry in Ghana is growing and has great potential, it is not devoid of problems. One of the major problems is the environmental hazards caused by packaging. Solid waste disposal, especially the littering of the country with paper packages, metal cans, broken bottles and plastic packages. In recent times, plastics have been a major concern. Most of these plastic packages are not biodegradable and therefore cause visual pollution by floating in water or dispersed on the ground and on burning they produce toxic fumes which is a health hazard. Waste management is a major problem and this problem has been compounded by the poor attitude of the populace to recycling of some of these packages.

There is also lack of statistical data or information on the amount of packages handled annually (both imported and locally produced) as well as the different types of packages involved. This makes it difficult to develop an effective waste management programme for the packaging industry. Some of these problems besetting the packaging industry may be overcome if some of these measures are implemented:

1. The populace should be educated on the importance of recycling and also on how to handle some of these packages. Entrepreneurs should also be encouraged to go into recycling or set up recycling companies to enable effective management of waste from the packaging sector.

2. Special taxes should be levied on companies involved in packaging to provide funds for bodies like the Environmental Protection Agency (EPA) and waste management departments of the Metropolitan assemblies such as Accra Metropolitan Assembly (AMA), Kumasi Metropolitan Assembly (KMA), etc, to effectively tackle the problem of waste from the industries.

3. Companies should be encouraged to use environmentally friendly packages and also to give guidelines as to the reuse of their packages.

4. Statistical data should be collected on the amount of packages handled within a given time and the type of packages involved to enable the development of effective waste management and recycling programmes.

5. The best package award should have as one of its criteria, a package which is environmentally friendly.

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