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A Critical Overview

of the

Package Development Process

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I. EXECUTIVE SUMMARY

The Definition of Packaging Development

Packaging is defined as a method or container made to protect products from damage. The products include but are not limited to: food, electronics, manufactured good items, etc. The process of packaging development involves input from a variety of disciplines and influences including history, science, economics, engineering, politics, and social responsibility. The following discussion will describe how these factors play into the process.

II. OVERVIEW OF PACKAGING INDUSTRY

A. History

The packaging industry is as old as products or shipment of those products from point A to point B. Typically early packages were made of animal skins or clay pots. Often the development of a particular society can be traced to its sophistication in the transporting or packaging of its materials. The Bible is full of packaging references: wine skins, water jars, earthen vessels, perfume jars, etc.

The history of modern packaging is closely linked to the development of glass and tin plated steel. Glass containers, with cork or similar stoppers, were utilized in the 18th century for the preservation of high quality and costly fluids such as wines, liquors, and perfumes. The only safe method of storing and distributing potentially hazardous chemicals was in a glass bottle or beaker with a glass stopper.

Following the development of tin plated steel, food preservation in the time honored **tin can** became a reality and vastly increased the ability of people to move away from readily available food sources. For the first time, packaging allowed true preservation of a wide variety of food products ranging from fruits and vegetables to meat and fish products. Because of the strength and relative low cost of the tin can, processes were developed for sterilizing food products within the container itself thus guaranteeing a high quality sterile product for a long period of time.

The development and widespread use of paper and paperboard in the late 18th century also enhanced the ability to preserve food and other products effectively and efficiently. Wax coated papers were often used to preserve freshness in food products that could be wrapped and sealed using the wax sealing surface on the paper.

In the 1950s the two piece aluminum can was developed and was quickly adopted for use in the beverage industry. Thus, by the mid 19th century packaging was predominantly a function of glass, paperboard, and metallic (tin plated steel and aluminum) containers.

In the 1960s, development of polymers produced an extremely rapid change in the characteristic of many package systems. The development of the blow molded polyethylene container (milk "jugs" and similar) heralded the ability to package liquids into a semi-flexible and much lighter weight medium than glass. In addition, the medium was non-breakable and provided a huge increase in the safety of transporting liquids.

The late 1960s saw the rapid development of polymeric films, primarily mono-filament and, later, co-extrusions (two or more films extruded together for enhanced protection properties) and laminates. Initially cellulose films and polymer films were used as a wax paper replacement but gradually grew into the ability to form very highly sophisticated moisture and oxygen barrier packages which provide excellent properties along with outstanding logistics. Within a 40 year period in the late 20th century, the makeup of most retail packages went from rigid round containers to primarily flexible and often rectangular containers in order to better utilize the logistics of the distribution systems, saving energy and natural resources.

In addition to the containment and protection functions of a package, the marketing of products through the package itself has been the subject of a vast amount of research, study, and professionalism over the past half century. The branding of a product through the use of a distinctive package or graphic style on the package is now commonplace. It is estimated that approximately 80% of the retail market involves graphic identification of a product by means of a package or the graphics thereon rather than the identification of the product itself prior to purchase. Thus, the graphic image and the marketing appeal of a package have more to do with the sale of the product than the configuration and characteristics of the product itself.

The protective function of a package is absolutely necessary for the distribution of those products which are fragile or breakable when exposed to the handling and vibration characteristics of product distribution. Highly engineered package systems are often necessary and are required for the safe delivery of products in an economically optimized fashion. The globalization of the world's economy would have been impossible without efficient and well designed packaging which is essential for optimizing the logistics of world-wide product distribution. The lack of adequate distribution and packaging was a major contributor to the downfall of the Soviet block countries, 55% of their produce spoiled from the time of harvest to retail due largely to inadequate packaging.

Consumers today enjoy products from a wide variety of locations throughout the world which are delivered in an economically optimized and overall integrated system. Moreover, they are available almost any time of the year, even for seasonable products. These benefits are largely the result of integrated logistics worldwide that would be impossible without efficient, effective, and highly engineered packaging systems. For example, most fresh fruit is now delivered in a Modified Atmosphere Package (MAP) system where the oxygen has been removed from the container thus greatly slowing down natural respiration and allowing for longer distribution cycles characteristic of the global economy. Another example is the wealth of electronic products (computers, printers, copiers, etc) largely assembled in

Asia and distributed worldwide. Often, these products are sized for optimum cube utilization in an ocean-going container and ruggedized to use a minimum of protective packaging with the goal of optimized logistics and minimum delivered cost.

B. Expertise Involved

There are disciplines involved in the design, manufacturing, and testing of package systems that are almost as diverse as the culture in which those products are consumed. Higher education identified the need for a disciplined approach to the packaging development process which has resulted in more than 15 schools of higher education offering under graduate degrees, masters degrees and doctoral degrees in packaging technology. The following is a partial listing of some of the disciplines necessary to create effective and efficient packaging in a modern society:

Mechanical engineers to design and fabricate package filling lines and package fabricating equipment

Electrical engineers for the controls for package manufacturing equipment, filling lines, and other electromechanical functions.

Packaging engineers to design and specify package systems, testing protocols, and other requirements for the package.

Industrial engineers to optimize material flow, logistics, and similar warehousing functions.

Chemical engineers to design and help formulate new polymers and co-polymer systems for more effective barrier properties on flexible package systems.

Graphic art skills to design package systems appealing to consumer point of purchase.

Marketing skills to present the product in the best possible light via the package system.

Medical skills and expertise to help design and test package systems for medical devices and pharmaceuticals.

The mission statement of the largest packaging association with over 5000 members, The Institute of Packaging Professionals, opens with the following statement:

"IOPP will be the center unifying force in packaging for the benefit of its members, the packaging community and society. IOPP is dedicated to the proposition that packaging is a positive, environmentally responsible and economically efficient force, operating in a modern economic society for the benefit and improved well being of its people". The IOPP has it’s national offices in the Chicago suburb of Naperville, Il.

C. Value to Society Over Time

It is hard to determine the exact value of packaging to a modern society. It is estimated that the average person has direct contact with more than 50 packages everyday. These packages provide a variety of benefits primarily around the protection, convenience, motivation, containment, security, and utility functions of a typical package system.

A wide variety of products would not exist at all or would be unavailable to most consumers, if it weren't for the package. Some of these products include the following:

- All carbonated liquids
- All aerosols
- All shelf stable food products
- Disposable medical devices
- Fresh produce, dried fruit and nuts
- Dairy products
- Meat, fish, and poultry

The Containment Function

This function of a package probably began as a convenience for associating products together rather than attempting to move them individually. Take for example a sack of potatoes. It is certainly much easier to put them into a gunny sack and carry them around than to handle the potatoes individually or by means of a rigid container or other method. Thus, the containment function of a package is probably the most basic. Likewise, it would be impossible to distribute most liquids were it not for the containment function of package systems.

The Protective Function

The protective function of a package is one that has progressed enormously over the past 40-50 years. Prior to 1950, it was generally assumed that products must be designed to survive the entire life cycle of the products, including distribution. Gradually, however, it was recognized that distribution represented for most products a much more severe environment than the in-use environment and packages were developed specifically to protect the product for this one specific portion of its life cycle. The development of the Damage Boundary theory of product fragility assessment significantly aided in the overall process of designing and testing optimized protective package systems. This led directly to the optimization of product ruggedness and package testing procedures which is now largely responsible for global distribution of goods in a damage free condition and at the lowest cost possible. For example, a large California based supplier of printers determines the

size and ruggedness of the product for optimum efficiency in distribution and minimizing packaging materials and costs.

The Motivation Function

The motivation function of the package at the retail level has grown by leaps and bounds as has the technology of printing and the understanding of motivational psychology with regard to human perception. Using color, shape, form and style, packages now provide for the primary marketing of most products sold at the retail level. Within a short period of time, the package must resonate with the potential customer and relate to a need within that client. The perception of that need satisfaction and the perceived enhancement in the customer's overall wellbeing results in the greatest percentage of purchasing motivation in most retail customers. Cosmetic companies in particular view the package as their "silent salesperson" in a market flooded with competitors where instant recognition is imperative.

The rapid improvement in printing technology experienced over the same time period can be traced to developments used originally on package systems. Flexography, lithography, and gravure printing methods and derivations of these are many times more effective following 50 years of wide spread usage in package production.

The Utility Function

Likewise, the utility function of a package has progressed enormously over the past 50-60 years and is responsible for many individual products as was mentioned earlier, as well as the safe and efficient use of existing products. Examples of these are numerous and include the following:

- Easy open/easy close features
- The use of promotional labels and coupons on packages
- Tamper-evident and child resistive closures
- Pilfer resistant packaging; reducing theft reduces cost to the consumer
- Point of purchase display, packaging, and mass merchandise systems
- Bundling of complimentary products into a single unit:
- Protecting the population from hazards products (chemicals, batteries, etc.)

A wide variety of products would not exist without the utility function built into the package system. These include shaving cream and edible cream or foamed products including gelatins and cheese. Products that require mixture prior to use such as two-part epoxies are easily dispensed by means of the proper package design but are messy and inconvenient otherwise.

The Convenience Function

The convenience function of the package makes our lives simpler and much more enjoyable on a daily basis. For example, most cosmetics and health care products come in packages that aid in the application or dispensing of the product. The

dispensing and use of many food products is enhanced by convenience features such as delivery spouts, pump or trigger systems and built-in measuring cups. Instructions for use and recipes, for example, are often included in packaging graphics to aid in the convenience of use of the product.

D. Scope of the Packaging Industry

It is estimated that one in every five individuals in the United States is employed directly or indirectly in a package-related function. In 2005, this would result in a packaging industry of approximately $400 billion. The exact magnitude and scope of the package industry would be difficult to quantify, largely because it is diverse and attached to the individual products for which it is intended. However, it is clear that the economy of the United States and the rest of the world relies heavily on packaging and packaging technology. The type of lifestyle that we lead, particularly in the United States, would be totally impossible without the advances and economies afforded by effective and optimized packaging.

It is estimated that the United States population spends approximately 10 to15% of their disposable income on food products. About half this dollar amount (but only one quarter of the volume amount) is consumed outside of the home. The ability to deliver food products in a fresh and serviceable condition through a wide variety of distribution channels to an incredibly diverse home, restaurant, and food service population is largely a function of efficient and effective packaging and food preservation techniques. The food products consumed in the home are the freshest, highest quality and cheapest that the world has ever known. This is almost exclusively the result of extensive packaging technology at work in this particular industry segment.

Bob Collins, director of global packaging at Proctor & Gamble says, " Packages no long address specific applications: rather they address different age groups, ethnic groups, etc. There have been a lot of material changes in the last 35 years which have offered huge advances on today's significant level of focus-sustainability, on material reduction, light weighting, and reduced cost for shipping material around the world"

With that in mind, Coke plans a huge material [polyester] recycling plant next year in South Carolina. They currently operate recycling plants in Australia, Austria, Mexico, the Philippines, and Switzerland.

Sustainability has become the focus of the Package development process. Bruce Knobeloch, Vice President of Marketing at River Ranch Food, Salinas, California, says," It's a balance of technology, cost, and making sure everything we do has green alternatives". Wal-Mart concentrates on reduced packaging material for their detergent marketing. Kraft Foods tries to help package designers make informed decisions with their Eco-Toolbox. The toolbox and emphasis on sustainable packaging has helped Kraft to find optimum design scenarios reducing material, increasing recycled content and/or reducing environmental impact upon disposal.

It could be argued effectively that the security of the world is dependent upon packaging technology as well. The modern army must deploy a large number of people quickly into remote areas and be able to sustain them for long periods of time without direct support. This is possible only by the use of packaging technology that allows high quality food products to be packaged and delivered with the troops in a form that is convenient, nutritious and easy to use. The MRE (meals ready to eat) food system developed by the U.S. Military over the past 30 years is a credible example of the use of packaging technology in the area of food products. This same technology is used during natural and man made disasters [fire, floods, wars, etc.].

III. THE PROCESS

A. All Inclusive Overview of the Package Design Process

1. Key Considerations

The package does not exist for its own sake. It is always designed to enhance certain features of a product or, at the very least, to protect the product during a particularly severe portion of its life cycle. The design function starts with the basic characteristics of a package (identified above) which include production, containment, utility, motivation, and convenience. The particular requirements of a certain product are then brought into play. These might include safety, toxicity, product-package compatibility, sustainability issues, and recyclability issues. In a global economy, the sourcing of the raw materials for the package and the expertise to fabricate the package are two key considerations.

To conduct this design process efficiently and effectively, the packaging engineer must have knowledge of a wide variety of different materials and processes and must have the latest information on recyclability in a given area in order to do the job most effectively. This is one of the primary reasons why packaging education is so important and is, in fact, vital to our economy and to our way of life. In addition it is the reason why the authors of this paper have dedicated their lives to packaging education to a large extent.

2. Development

After the key considerations and functions of the package have been established, it is necessary to develop a prototype using the materials selected for the process. Typically this involves a multi-disciplinary approach with heavy emphasis on fabrication techniques for various materials, graphics, printing technology, logistics, package filling techniques, and a variety of others. Generally, these functions are combined in a fashion that makes the development of a prototype package possible so that all parties interested can submit the input for a final package design. Project management skills are generally crucial to the success of this particular step.

3. Regulatory Oversight for Certain Products

The package development process is heavily regulated by various government agencies. For example, the shipment of hazardous materials is regulated by the Department of Transportation, the shipment of medical and pharmaceutical products is regulated by the Food and Drug Administration, and fresh produce, dairy, meats and poultry are regulated by the USDA. In each case, regulatory requirements must be understood and fulfilled by the design of the package system. In addition, the fulfillment of these design requirements must also be defended typically by the package developer or packaging engineer. Now days this involves a substantial amount of laboratory testing which must be selected, conducted, and reviewed for accuracy and completeness.

In each case, the effectiveness and function of a package cannot be underestimated. For example, the shipment of hazardous material need not be a hazardous operation provided that the package has been properly designed and tested. If the proper protocols have been satisfied, the shipment of hazardous material should be as benign as the shipment of water. Likewise, the shipment of a medical device or pharmaceutical product requires that a package not only protect the product during transit and storage, but also guarantee that the product is in a sterile condition regardless of the circumstances of the delivery. It is not an exaggeration to say that the advancement in medical technology could never have occurred to the extent it did without effective and efficient packaging. It is one thing to invent a wonderful device for non-intrusive brain surgery, for example. It is something else entirely to distribute that device worldwide in an efficient, damage-free, and sterile condition ready for surgery where a successful result is now the expectation. None of this would be possible without professional packaging expertise.

4. Production, Distribution, and Consumer Interaction

The next step in the package development process considers how the product is actually produced, how it is to be distributed to its relevant clients, and how it must be presented to the customer at the final destination.

Many products have very specialized production requirements which require the package to be integrated with the product in a unique way. For example, production of large medical or electronic devices frequently requires that the product itself be manufactured on the base of the package. Other products are manufactured in a "clean room" environment and require that the package also be of "clean room" quality so that it can help guarantee the cleanliness of the product throughout the distribution process.

Perhaps the most common example of this particular process is food packaging. On a daily basis throughout the world, millions of people will grab a package of food product, open it, and assume that it is ready to eat out of the package. This requires that the package material be compatible with the food

product itself and that it be sufficiently clean to avoid contamination for those eating the food product directly out of the package. While this process is crucial, often it will come into direct conflict with other functions of the package, especially recyclability and recycling as we shall discuss later.

Of prime importance is the fact that a vast majority of products are never seen by the consumer prior to opening the package. The consumers receive that critical first impression of the product by merely looking at the package. The package must display the type of image and out-of-box experience that is crucial to customer satisfaction and to repeat purchases for those products. The importance of packaging in creating a good first product impression with the consumer has been recognized by certain industries, primarily cosmetic industries, for a long period of time. The wider use of package image has created the ability for newer products to compete with established brands and to level the playing field for entry into stiffly competitive areas such as food products, household chemical products and cosmetics, and a variety of others. The package is the primary sales agent for many products and to ignore this is to doom the product to failure in the marketplace.

5. Disposal, Life Cycle, Sustainable, and Renewable Resource Issues

After the package has successfully performed its service, it must be disposed of, in most cases. While we would like to claim that most packages are recycled or reused in a proficient and efficient way, the sad reality of our society is that most packages are disposed of in municipal landfills. However, there are some significant exceptions to this rule, and the package designer must be aware of techniques to assist in package recycling, particularly in those areas where it is common.

An example of the above is the use of corrugated fiberboard (cardboard) and the sealing techniques used on shipping containers. For example, it is well known that the use of a simple starch adhesive to close a container results in the most easily recycled box since starch adhesives are easily hydrolyzed in the recycling process. However, starch base adhesives require greater investments in capital equipment on a typical package filling line when compared to other methods such as polymeric tape. The decision to use the cheaper method is often dictated by company management and is outside the realm of the typical authority of a packaging engineer or package designer. Thus, the entire recyclability of an otherwise easily recycled packaging system is oftentimes dictated by company management in an attempt to save money in a capital intensive environment. This pennywise, pound foolish approach is often blamed on a poor package design or laid at the footstool of the packaging profession when, in reality, it is a corporate decision that most packaging professionals would abhor.

A promising life cycle trend in Europe is worth examining. This philosophy treats the life cycle of the product and the package in a similar fashion. That is to say, the life cycle of the package is not complete until it has been reused or

recycled in an efficient and effective way. Thus, the design process must not only guarantee successful delivery of the product, it must also include the effective reuse and recycling of the package in a variety of different environments.

Utilization of this approach is not limited to strictly packaging design but must also consider the product and the consumer attitudes about what the product must do. For example, the use of a “pop top” feature on most aluminum beverage cans is only available by using a different aluminum alloy for the top of the container than is used for the body of the container. Since both portions of the container are recycled together, this results in a contamination of the alloys and limits the effectiveness of recycling of aluminum containers (rheology). In order to make the entire can of the same body alloy of aluminum, it would be necessary to give up the pop top feature of the current day aluminum can. All beverage companies agree that this option would not be acceptable to the current customer for carbonated beverages. Therefore, this less than desirable situation is allowed to continue based solely on customer demand, not on the physical requirements and design of the package system.

IV. THE BENEFITS OF PACKAGING IN OUR CURRENT SOCIETY

The following is brief summary of some of the benefits available through modern technology applied to packaging within our society in the early 21st century in the United States and other developed countries.

A. Safety

As was mentioned earlier, the shipment of hazardous materials is no longer a hazardous function due to rigorous package design and testing necessary for this product type. Hazardous materials used in a wide variety of areas, from medical devices to explosive technology devices, can be safely and easily shipped by means of the package design and the testing that went behind it.

The widespread use of polymeric containers in place of glass containers has resulted in a substantial safety improvement through the elimination of broken glass containers. This transformation has been so complete during the past two generations that the current and primary use of glass container is for a certain brand appeal or image requirement rather than for product protection. In addition there are tremendous savings in transportation costs with polymeric containers.

B. Value to the Product

Previously we pointed out that there are a large number of products that could not exist in our society without the use of a specifically designed package system. In addition to those products, the enhancement of desirable product characteristics such as freshness and color retention is possible by means of effective and efficient package design and the correct use of materials and material combinations. This is

important for fresh produce, meat, dairy, poultry and fish. The marketing of shelf stable food products for both rigid and flexible containers would be impossible without the effective and efficient use of packaging materials and systems.

C. Cost

For all its complexity and engineering content, the total cost of packaging, both in real terms and as a percentage of the product, has decreased dramatically over the past two generations and continues to do so. There is something of a threat on the horizon, however. As the underdeveloped economies of the world begin to flourish, China, India, etc., a greater demand for packaging has influenced the world capacity for protective packaging and increased world prices for polymers as well.

D. Convenience

The convenience level built into modern packaging, especially in developed countries, is hard to categorize or determine the scope of because of its breadth and the fact that it was introduced over a long period of time. The following list gives a reasonably good idea of the types of conveniences that we are talking about. Sometimes these conveniences are a true lessening of effort necessary to dispense or use the product and sometimes they greatly enhance the safety and efficacy of the product itself. This supports the need and use of re-sealable packaging with advanced closure systems including zippers, sliders and adhesives. These also added the dimension of easy open features engineered into the package.
"Smart Packaging" which adds value and information for the consumer with indicia films and inks, oxygen scavengers, selective barriers and many more, is another example of modern packaging development enhancing both convenience and utility.

E. Environmental Benefits

Even though the package is considered to be a primary source of environmental impact in terms of its disposal problems, the simple fact is that without the enormous packaging improvements of the past 40 years, the environmental impact would be several times more than the current level. For example, the wide use of polymeric containers in place of a glass equivalent results in about $1/10^{th}$ the energy necessary to melt and form an equivalent glass container. When the extra transportation cost necessary for glass container delivery is added into the equation, the environmental impact of packaging over the past two generations is actually substantially less than it would have been without the wide use of polymers in packaging. As more and more products go into highly engineered flexible packages, the continued environmental benefit of packaging development will be enhanced even further. Flexible polymeric packages take up 1/10th or less the space in a land fill as their rigid counterparts but offer equal or improved product protection.

It is important to note that approximately 80% of the packaging dollar is spent on those commodities found in the average grocery market, typically food products,

household chemical products, personal care products, and similar items. For many of these products, the only thing that remains after product consumption is the package which must be disposed of by recycling ideally, but more often through simple disposal in a landfill. Also, the consumption of the product, typically by human beings, results in solid waste which must then be taken care of by municipal solid waste sanitary systems. While these systems are a necessary part of our lifestyle, they do result in enormous environmental impacts. Packaging in its totality is no different. It results from human activity, needs, wants, desires, safety, etc. and must be conceptualized and dealt with in a similar fashion.

V. THE MYTH OF ALTERNATIVES

Those who study the issues of environmental contamination and recyclability are prone to use a broad brush approach and simply proclaim that packaging, per se, is overdone and should be reduced or eliminated. While it is true that examples of waste and inefficiency in the packaging arena can be found, this waste and inefficiency exists in no greater extent nor percentage than in any other identifiable product, group or function within the modern economy. The simple fact is that packaging reflects the lifestyle of the people who use it, and to reduce or eliminate the current packaging innovations in the marketplace would be to turn back the clock for society as a whole, not just the packaging component thereof. An analysis of the lifestyle prevalent in America three to five generations ago would find very few of us willing to go back to that type of environment. Life spans were shorter, life was harder, and almost everything imaginable was more difficult. Technology will continue to forge ahead and to develop better and more efficient packaging driven, in part, by "Corporate Social Responsibility", cost, and efficiency, but it will never do so at the expense of our safety.

The current lifestyle that we enjoy is due in large part to the convenience, protection, and utility functions built into package systems. It is true that most of these are taken for granted and would not be clearly identified and missed until they are gone. For example, most modern surgical techniques would be impossible without the highly engineered package systems used for the devices that make these procedures possible. Poisoning of children by the accidental eating of drugs would be commonplace. Spoilage of food products would be many times the rate it is today. The weight of most product package systems would be very much higher than it is today, and many products would be simply unavailable without the package systems that make them viable in the marketplace.

VI. SUMMARY

It is clear that a major portion of the lifestyle we enjoy in the United States and other developed countries is attributable to advances and engineering in the area of packaging and product delivery systems. These package systems are beneficial and greatly enhance our ability to use products in a convenient and safe manner. The overall cost of this packaging effort in real terms to our society is far less than it would have been had these innovations not occurred.

Clearly, it is evident that the current methods and procedures of package design and development are the result of highly motivated and trained professionals with a wide variety of skills combined with the demands of the marketplace. Packaging is indeed not only a benefit to our global society but in some very significant ways, the primary reason why we enjoy the lifestyle we do. It would be very difficult, if not impossible, to imagine how different our lives would be today without the enormous benefits that packaging brings on a daily basis.

Furthermore, many packaging professionals and academians believe that packaging will help save the world within two generations. Consider that the world population in early 2008 is about 6.8 billion. Demographers are reasonably certain the peak population level will occur in about 2055 with about 11.6 billion mouths to feed daily. Without food, people riot, wars are common, and society breaks down totally. The only way to sustainably feed this number of people is with minimally processed food packaged in a shelf stable configuration (requiring no refrigeration) in a manner that is easily and efficiently stored, delivered, and consumed. Of this we are reasonably certain. To make this happen, we need dedicated researchers trained to fully develop emerging technologies, sometimes referred to as “Smart Packaging”, so that packaging systems will be ready and in place when the world approaches it’s population crest. Thus, packaging education today will be one of the key factors in helping to save the world in 40 years when the crunch time hits. That is one of the primary reasons why the authors of this paper have dedicated a majority of their professional lives to promoting and teaching packaging related topics and why we offer this insight into the value of packaging to society. We firmly believe there are few higher callings and that the world in general and our society in particular desperately needs to hear this message.

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Critical Overview of the Package Development Process

How Packaging Will Save the World in our Lifetime

Presented by:

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TAPPI
people resources solutions

Hysterical Overview

- **The history of Package Development is tied to the materials used:**
  - **Animal skins, woven fibres**
  - **Earthen vessels**
  - **Glass**
  - **Tin plated steel**
  - **Paper and similar fibre-based mat'ls**
  - **Aluminum; rigid & flexible**
  - **Polymer based; rigid & flexible**

Packaging Functions

- **Classical List:**
  - **Containment**
  - **Protection**
  - **Communication**
  - **Utility**
- **Others:**
  - **Motivation (mkt), environment, logistics, safety & security, convenience, etc.**

Value to Society

- **Hard to estimate the value of Packaging to modern society**
- **A long list of products would be unavailable sans-packaging:**
  - **Carbonated liquids & aerosols**
  - **Shelf stable food products**
  - **Disposable medical devices**
  - **Dairy, meat, fish, poultry, etc.**

The Containment Function of a Package

- **The most basic function**
- **Easier to put all the potatoes into a sack than carrying them one at a time**
- **Liquids would be a challenge**
- **Purse, suitcase, etc are all specialized packages**

The Protective Function of a Package

- **Makes the "tech life" possible**
- **"Damage Boundary" theory made protective pkg design & test a scientific process**
- **Global distribution is impossible without protective pkg**
- **Pharm, Med Devices, electronics, food, consumer prod., all rely heavily on protective packaging**

The Communication Function of a Package

- **Marketing: most packages are the products only salesman**
- **Identify contents**
- **Display safety information & critical functions**
- **Differentiates products**

The Utility Function of a Package

- **Includes convenience items like spray pumps, measuring cups, dispensers, receipts, etc.**
- **Other numerous functions often overlooked:**
  - **Easy open/easy close features**
  - **Promotional labels**
  - **Tamper evident functions**

The Utility Function of a Package – con't

- Child-resistive closures
- Pilfer resistant features
- Point of purchase display + package
- Bundling of complimentary products
- Safe distribution of hazardous products
- Cold chain distribution (pharm, flowers, produce, etc.)
- Makes reverse logistics possible

Scope of the Packaging Industry

- About $500B in 2005 dollars
- One in five US workers are involved directly or indirectly in packaging!
- US spends less % of total income on food & disposables than any nation
- US has the highest quality food and consumable products in the world
- Considered a leading economic indicator

The Package Development Process

- **Key Considerations:**
  - **Pkg exists for a product, not for itself**
  - **Starts with the "Functions"**
  - **Add special requirements**
  - **Knowledge of materials is crucial**
  - **Packaging education is necessary**

The Package Development Process

- **Development**
  - **Prototyping is generally used to generate realistic samples for approval of:**
    - **Production, filling, logistics, trade**
    - **Graphics**
    - **Legal & regulatory,**
    - **Marketing, customer studies,**
    - **Sustainability & environmental**
    - **Finance**
    - **Purchasing**

The Package Development Process

- **Regulatory oversight & Packaging**
  - **Hazmat (DOT)**
  - **FDA**
  - **USDA**
  - **Treasury (Liquor, tobacco, etc)**

The Package Development Process

- **Production, distribution & consumer interaction**
  - **Many products demand very specialized packages that are often highly engineered**
  - **Packages must take into account how the consumer will use the product**
  - **Materials must be correct and available**
  - **Out of box experience is important**
  - **Product appeal is package-dependent**
  - **Innovative packaging can allow new product entry into highly competitive markets**

The Package Development Process

- **Disposal, Life Cycle, Sustainability issues**
  - **About 1/3 of all of all pkg material is reused**
  - **Aluminum bev cans claim about 94% recycle rate**
  - **Paper based packages claim up to 55% recycle rate due largely to corr'd recycling**
  - **Polymer based pkg can be recycled at a high level given the right priority, poor at present**
  - **About 1/3 of a typical landfill is pkg related and the level is decreasing**

The Package Development Process

- **Disposal, Life Cycle, Sustainability issues**
  - **A promising trend (Europe) treats the ENTIRE life cycle of the product AND the package together from cradle to cradle. Both product and package must be designed to include effective reuse and/or recycling in a variety of different environments.**
  - **Lots of barriers**
  - **Rethink our concept of convenience (pop-top)**
  - **Longer range thought process is required**

Packaging Benefits to Society

- **Safety:**
  - **Hazmat**
  - **No breakage with polymeric containers**
- **Enhanced Product Value**
  - **Many products wouldn't exist w/o the pkg**
  - **Freshness and shelf life of produce, meat, dairy, poultry, fish, etc.**
  - **Lots of other examples**

Packaging Benefits to Society

- **Cost**
  - **In both real terms and as a % of product cost packaging has decreased for over 2 generations**
- **Convenience**
  - **Dispensers, easy open/close, measuring devices, see-through, handles,**

Packaging Benefits to Society

- **Environmental Benefits**
  - **Packaging recycling has been improving consistently over the past 40 yrs.**
  - **Polymeric containers use 1/10 the energy to form and ship than an equivalent glass container**
  - **Flexible containers take up less than 10% of the landfill space as rigid containers**
  - **80% of the PACKAGING $ = consumer products (food, chemicals, personal care).**
- **Pkg recycling is mainly a lifestyle issue.**

The Myth of Alternatives

- **Waste & inefficiency is about the same as other identifiable products, groups, or functions**
- **Packaging reflects the LIFESTYLE of those who use it**
- **The convenience, protection, & utility functions built into modern packaging actually will define the "lifestyle" of the users to a large extent**

The Myth of Alternatives

- **Technology and social responsibility will drive incremental improvements in efficiency and recyclability.**
- **Lifestyle will drive major improvements**
- **Most of packaging is socially very positive (med device pkg, child-resistant closures, etc)**
- **Well designed packaging will have a major influence on our ability to survive as a people…**

How Packaging Will Save the World…

- **Premise: food is a basic human need**
- **In 2009 there were about 6.9 BILLION people in the world**
- **Demographers tell us there will be about 11.6 BILLION people in 2055**
- **CAN WE FEED THEM???**

How Packaging Will Save the World…

- **The World Food Organization says "yes" we currently produce sufficient food to feed about 11.5 billion**
- **Is this "sustainable" agriculture??? Good Question!!! Probably not… Heavy dependence on petrochemicals**

How Packaging Will Save the World…

- **TWO primary food problems:**
  1. **Half of the 3rd world food spoils <u>prior</u> to reaching the consumer**
  2. **Half of "developed" world food is discarded <u>after</u> it reaches the consumer**

How Packaging Will Save the World…

- **Problem #2 is yet another lifestyle issue**
- **Problem #1 is a packaging/logistics issue**

How Packaging Will Save the World…

- **What's needed is a means for "minimal" food processing followed by a "smart package" capable of long term shelf stable storage.**

How Packaging Will Save the World…

- **Examples of this "smart package" may include:**
  - **Flexible pack with**
    - **Oxygen scavengers**
    - **Anti-microbial agents embedded in the walls**
    - **One way gas transmission capability**

How Packaging Will Save the World…

- **Rigid pack for multi-unit use**
  - **Shelf stable modified atmosphere pack**
  - **Solar oven pack**
  - **Elimination of round, oval packs**
- **Lots of other possibilities…**

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PLACE

POLYMERS • LAMINATIONS • ADHESIVES • COATINGS • EXTRUSIONS

How Packaging Will Save the World…

- **To have these new packages ready in the 2040's, we need:**
  - **The processes and materials in the 2030's**
  - **The smart & motivated people to develop them in the 2020's, AND**
  - **The students interested in starting the process in the 2010's**

How Packaging Will Save the World…

- **Thus:**
  - **Packaging education is the key to saving the world in the next 2 generations**
  - **Flexible packaging materials are the key to the process**
  - **The time to start this process is now!!!**

Thank you

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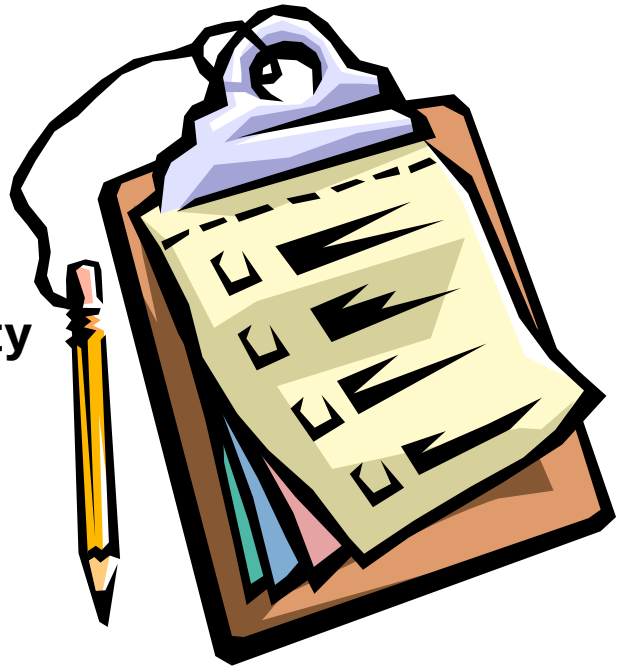

Please remember to turn in your evaluation sheet…