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Improvement of packaging as one of the key terms of the efficient economy development

Edward Goldberg

IMPROVEMENT OF PACKAGING AS ONE OF THE KEY TERMS OF THE EFFICIENT ECONOMY DEVELOPMENT

(Analysis of the experience of the USA and problems of Russia)

By

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ABSTRACT

This paper presents the analysis of the modern packaging technology in the United States, summarizing and featuring the important points and aspects that can be implemented in Russia.

The paper emphasizes the important role of packaging in advertising, marketing, distribution and shipping of products, as well as its necessity in order to maintain the products and packaging integrity during shipment and distribution.

The level of packaging identity in Russia is close or may be a little bit above zero; the paper gives the detailed analysis of current state of the Russian packaging industry, food distribution and the current trends in packaging improvement.

The study provides the basic ideas on structuring logistics management in the US, which plays an important role in business process in the majority of the industrialized countries, giving specific examples and figures from the latest scientific sources.

The Present situation in the Russian Packaging Industry

In the newly independent states of the former USSR, there is a major concern about food packaging. Never recognized as an industry, it has been part of the ministries of food production, chemistry, medicine, pharmaceuticals and so on. Practically all USSR packaging research and development was 20-25 years behind that of the West. Technology introduced in the '60s in the West only now is being used in Russia and Ukraine for experimental production runs. Wide-scale use of such materials as shrink and stretch films seems to be in the distant future.

During the Communist era, especially in the last decade, there were numerous party and government plans to improve packaging, but those plans did not produce satisfactory results. With the collapse of the political system, the situation has grown worse.

For decades food preservation was never a major concern, while the government called for more grain, fruits and vegetables to be harvested and more meat and milk to be produced. As a result, raw food losses for years were more than 30% of the total. At present, the country loses about 1 million metric tons of its meat, 50% of its grain, 45% of its vegetables, 55% of fresh vegetables, 70% of potatoes, and 1.5 million tons of fish to spoilage.

In 1989, the USSR's output of potatoes, milk, sugar, butter and fish was higher than of the US. Despite that, food was in short supply. In 1990, the country wasted a

record amount of grain. At 240 million metric tons, the Soviet harvest was the biggest in history. But as much as 45 million tons were wasted in harvesting, and 35 million more rotted in storage and processing. About 40 million went to animal fodder. That left only about half the harvest for human consumption.[1] According to R.Andreas, the chairman of Archer Daniels Midland (ADM), the food-distribution system needs 100 new processing plants and 50 million tons of storage space.

Although enough food is being produced and prices are sky-rocketing, there is still too little getting into stores. The main reasons are poor planning, lack of investment, managerial incompetence, corruption, theft, poor storage and refrigeration, inadequate processing facilities, and a lack of suitable packaging and distribution systems. A major item of the Commonwealth of Independent States (CIS) shopping list is packaging, which is virtually non-exist. Packaging was neglected by the central planners for more than 70 years, emphasizing the production of foods without concern for preservation and distribution. The Soviet system failed to deliver food to the people.

The traditional structure of the country's food packaging and processing industry was always a problem. Production facilities for most containers and container materials were scattered and regulated by separate ministries. Tinned steel consumption for a typical cannery in Russia or Ukraine is about 50 to 200 tons per year. The antiquated can making equipment at these facilities is utilized at only 10-15%, driving the cost of canned products up.

Polymer and petrochemical industries are far from satisfying the ever-growing demand for plastic. They provide only 20-25% of the market demand in shrink film,

producing film that cannot compete with quality imports. Production of coextruded laminates, stretch films, oxygen-impermeable polyester films, and copolymer films is yet in the planning stages.

Despite its huge forest resources, Russia still imports 50% of paper for packaging needs (Table 1-1).

	COUNTRY	% of Total
1	U.S.A.	29.3%
2	Japan	12.1%
3	Canada	7.0%
4	Germany	5.5%
5	China (P.R. of)	4.8%
6	Former U.S.S.R.	4.1%
7	Finland	3.8%
8	Sweden	3.4%
9	France	3.2%
10	Italy	2.4%
	Total 10 Countries	75.6%
	('000's of Tonnes)	210,404
	Total World	100.0%
	('000's of Tonnes)	278,230

Source: "Pulp and Paper Capacities, Survey 1991-1996", FAO of the United Nations.

Table 1-1 **Ranking of 1991 Paper and Paperboard Capacities**[2]

Domestic folding cartons cannot be used for automatic high-speed setup, filling, and closing because of warping, exfoliation, and low strength. In addition, the CIS equivalent of the US federal Food and Drug Administration (FDA) restricts the use of domestic board for food packaging due to the shedding of fibers.

Domestic label stock is behind in quality, having questionable whiteness and a surface not smooth enough for printing. Printed wax paper wraps are still being produced with high porosity, leading to product contamination with printing ink.

Demand for modern processing and packaging equipment is still very high, with automated production lines for perishables, (like ground meat, fruits and vegetables) at the top of the list. The majority of equipment in the food industry is imported and has been in operation, on average, about 10 to 20 years. The most advanced processing and packaging lines were bought from England in the late 1960s. Manual labor in packaging is 44%; equipment wear is 70%. This situation causes shortages in packages and materials already available in the industry.

Among the machinery needed most are the following: carton die-cutting and forming equipment, extruders and coextruders for packaging films, thermoforming lines for blister packages, machinery to produce polyethylene-coated paper for food packaging, thermoformer for plastic cups and trays, tamper-resistant closure equipment for beverages and can-making lines. Even today, 60% of all food is sold unpackaged.[3]

One of the most urgent social and economic challenges for the CIS and Eastern European countries is to ensure that the people are adequately supplied with good quality food stuffs. A major barrier to achieving this goal is not so much food production but food spoilage on an enormous scale, caused to a large extent by inadequate distribution and packaging systems. Russia, for instance, produces enough basic foodstuffs such as grain, meat and potatoes to feed itself, but so little reaches consumers in Moscow that there are famine fears there.

Figures from Marketpower, the UK- based research consultancy, show that on average 2.4% of potatoes and 0.2% of apples are spoiled each year in Western Europe, whereas the average figures for Eastern Europe are 32% and 45 % respectively. In some

parts of the CIS, spoilage rates reach an average of 50% across a range of foodstuffs, according to Professor David Pearce of London University.[4]

Modern packaging systems are desperately needed by all these countries, which they themselves recognize not only to alleviate food shortages, but also to enable them to produce food for export and earn vital hard currency to rebuild their food manufacturing base. The CIS realizes that a chronic lack of any packaging materials is one of the reasons that it has a production and supply problem with baby foods of all types: currently it is producing only 18% of the required amount of milk based baby food.

Aseptic carton packaging needs little refrigeration and will preserve food and milk in very good condition over long distances and times.

One of the most important causes of shortages is food spoilage. Each year one-third of Russia's grain, a million tons of meat, and almost one half of milk protein and potatos are lost. Food spoilage on such a vast scale is the result of inadequate distribution and packaging systems. Processing and packaging systems could reduce food spoilage to between two and three percent as in the US and Western Europe, compared with up to 50% in the CIS.

In terms of packaging in the CIS there are four major problems, which are, in the order of importance:

- Shortage of suitable packaging materials of all kinds,
- Shortage of adequate packaging machining equipment,
- Poor technical quality of packages, and

- Poor outer design of packages.

Help and investment by Western packaging companies is essential to solve these problems because they can bring in the packaging solutions of more then a hundred years of experience.

There is an obvious and tremendous need for modern packaging solutions for a wide range of products, but nowhere is the need more pressing than to alleviate the chronic under-production of baby foods, whether vegetable, meat or milk-based. The problem for the Russian republic is particularly acute as it has only around 30% of the CIS's existing baby food production, a very low proportion given Russia has by far the biggest baby population.

At present the production of milk-based foods, within the CIS as a whole is only about 18% of what it should be, baby food cans containing fruit or vegetables is 43% of total needs, while baby food cans containing fruit or vegetables is 43% of total needs, while baby food cans containing meat is only 21% of the required amount.
The urgent need for packaging materials for all kinds of baby foods means that the CIS has not the luxury at this point of engaging in overly protracted arguments about which packaging material for baby food has the best environmental profile, although these considerations will become more important when the population is being properly fed. The priority now is surely getting as much milk and milk-based products from cow to children as possible in a hygienic manner.

Looking at milk as a whole, less than 60% of the consumption milk and fermented milk products produced at Russian diaries are packed in consumer packages.

The remainder is distributed in bulk, or worse, it goes nowhere because of lack of packaging and is wasted. The bulk distribution is done through large metal churns called "flyagy", typically containing 20 to 50 liters.

The beverage carton is a very efficient and hygienic packaging solution for alleviating the CIS's food shortages for baby foods and other products. The aseptic package is particularly ideal because it requires little refrigeration and will preserve food and milk over long periods of time, and therefore can cope well with a poor transport and distribution infrastructure.

Self-service containers where consumers can fill their own bottles with milk or juice are often advocated in the West as being the most ecologically sound packaging system.

The reality for the CIS countries is that screw-lids do not exist for bottles (lids for jars/bottles are made of tin and are not recloseable), so when consumers bring their own jars for filling, they have to be put into plastics pouches and carried home in an upright position.

The aseptic carton based packaging is the best option currently available. Health considerations are seen as paramount in terms of choosing packaging systems in a country where 11.5% of dairy products cannot be guaranteed as safe and 50% of children suffer from a chronic, figures given out as a recent press. The average glass packaging line could use 98 square meters-of floor space and needs seven people to run it, whereas an aseptic carton line would require only 18 square meteres and one person. The treatment of the milk being filled into aseptic packaging would also ensure that the

quality of the milk would not deteriorate before it could be consumed. Currently, one percent of the consumption of milk is packed in aseptic carton packages.

Introducing modern packaging solutions has therefore been identified as an area of strategic importance by the national governments in Eastern Europe and also by investment institutions such as the European Bank for Reconstruction and Development (EBRD). These institutions recognize that good quality packaging will not only reduce food spoilage and improve living standards within the countries of Eastern Europe, but will also facilitate the export of goods, enabling manufacturing companies to earn the hard currency that is needed to upgrade the manufacturing base.

According to Marketpower, the value of the packaging industry in Eastern Europe is set to grow from the 1990 level of Ecu 37.8 million (about 30 million US $) to Ecu 74 million (about 60 million US $) by 1995, with growth rates of 14% per year predicted for the CIS, Czechoslovakia and Poland.[5] In Czechoslovakia, the introduction of carton-based packaging has helped to solve the problem of leaking packages, off flavors, and the effect of light that liquid food products, in particular milk in plastics pouches, have been plagued with in the past. The introduction of aseptic packaging cartons has also meant that retailers can now be sure that the milk will not have spoiled by the time that it has reached the consumer.

Poor cooling systems and long distances of distribution have meant that in the past milk has often gone sour.

The Moscow-Brest highway, along which much of the aid from Europe travels, is supposed to be one of the best in the country. In fact, the highway is completely unlit

(except for the 50 yard on either side of occasional police stations) and pitted with unexpected potholes.

In the West, food-storage facilities are located mostly in the country-side, close to the place of production. In Russia, produce generally goes from the field into trucks or railway cars that haul it to city warehouses. The result: shipments of spoiled produce, along with rocks, mud and other refuse. Although the Russian government has issued a decree breaking up state and collective farms, the system is simply not adopted to small producers. The smallest shipment that railway authorities accept, for example, is usually one full freight car. And for collectives, only the state distribution system can absorb their huge output.

Many of today's problems are a hangover from 70 years of centralized planning. But the move toward a free market economy is also wreaking havoc, especially new pricing mechanisms which are pushing many staple foodstuffs out of reach.

According to Professor Pearce, "We must not run away with the idea that packaging will save all the food that is lost, but it does have a contribution to make."

While there is no doubt that problems will continue, a lot of experts believe that the market offers incredible opportunities for both Russian Packaging and Western companies who are willing to gamble and move into the Russian market.
Teresa Presas, of Tetra Pak Europe, said: "We believe there is a bright future for food distribution in the former Soviet Union and without importing food - but packaging is necessary element in this development."

Packaging role and importance in the U.S. economy

Packaging is a major contributor of jobs and revenue to the U.S. economy. Over one-half million people earn their livelihood making packages and packaging materials and many more are responsible for packaging the vast array of consumer and industrial goods produced in this country. Virtually nothing is made that is not packaged at some point in the manufacturing cycle. Packaging is a $70 billion business in the United States, the third largest in terms of sales.

In spite of the size of the packaging business, it contributes less than 2 percent to the $4 trillion U.S. gross national product. Packaging also makes up a relatively small percentage of the cost of goods sold. On average, packaging costs are about 7% of the price consumers pay for any given product. Yet, for this relatively small cost, packaging's role is to protect and market almost all of the products produced by other sectors of the economy.

In the all-important area of food production and distribution, in underdeveloped countries where packaging is minimal to non-existent, losses of 30-50 percent between the producer and consumer are not uncommon. In the U.S. that figure is less than 3 percent for processed foods due primarily to protective packaging.

What a package does for the consumer

The primary functions of a package are containment, protection, information and utility-of-use (convenience).

Containment simply means that the package provides a means of carrying or holding a product. Most products in a modern society require some type of containment, or they would be of little use.

Protection and preservation, taken together, constitute the next function. Protection and preservation, exemplified by the canning process, furnishes high quality, uncontaminated foods on a year-round basis. Canning has been supplemented by high quality frozen foods and, more recently, by other innovative packaging and preservation technologies. These include aseptic packaging, to provide shelf-stable milk and juices, and controlled and modified atmosphere packaging that permits fresh entrees, pastas, cooked meats and similar foods to remain fresh in the cooler for weeks.

Protection extends beyond protecting the packaged product from the hazards of the environment and the distribution system.

Sanitation, to ensure the purity of packaged foods, is the norm in modern food systems. Food is packaged in government-approved processing plants and is protected from contamination from insects, rodents, or humans until it is ready for use in the home. In another area of product protection, tamper resistant and tamper evident packaging (common in drug packaging) is now becoming commonplace in food packaging to help assure consumers that the foods they select are free from tampering.

Information is an often-overlooked packaging function. In its simplest terms, it tells the consumer what is in the package. The can without a label is a clear example of a package without information. Modern food packages convey far more information than simply telling the consumer what is inside. Through pictures or transparent packages,

the consumer is informed about the appearance of the packaged product. Through printed information the consumer is informed about the ingredients and, often, the nutritional value of a packaged food. Through print, color and shape a package conveys images of brand and quality to the consumer.

Utility-of-use (convenience) is the fourth packaging function. Packages make it easy to use the product. A recent popular innovation in food packaging is the squeeze bottle for ketchup which, in many ways is more convenient (has greater utility) than the glass bottle it replaced. It is resistant to breakage and is lighter and easier to carry. It is also squeezable, eliminating the struggle to initially get the ketchup to flow from the bottle (and to get it to stop). The choice of package sizes, ranging from "large economy" to individual portion, is an example of utility-of-use to satisfy individual needs, the large family or the institutional customer. Aerosol dispensers, microwave packaging and cook-in, eat-in packages are other examples of how packaging makes products easier to use.

Industrial/institutional packaging and retail packaging

Packages can be categorized into those that consumers see and use (retail packages) and those that the consumer generally does not see or use (industrial/institutional).

Improvements in industrial/institutional packages in recent years have increased efficiency and lower costs in many service industries. The best example is the delivery of health and medical service. Sterile supplies and medicines, prepackaged in needed

amounts, have simplified and reduced the risk during many hospital and medical office procedures. For example, surgical kits holding all the equipment and materials needed for a particular surgical procedure in a protected sterile condition are used in hospital operating rooms; prepackaged sterile laboratory equipment is used in hospital and research laboratories to simplify and speed up laboratory analyses and to assure quality control; and.flexible bags for blood and intravenous solutions provide for sterility and easier storage, and greatly reduce the risk of breakage in emergency situations.

Food protection and preservation

Food and beverage packaging accounts for, by far, the greatest proportion of the industry-approximately two-thirds of the $70 billion industry in the U.S. New technologies and trends often appear first in the food sector and then find their way into other packaging branches.

In a modern U.S. supermarket, where most food for home consumption is purchased, everything is generally packaged, either by the manufacturer, distributor or retail outlet (and a lot of fresh produce is pacakged - too, e.g. 1lb carrots etc.).

Food is the most perishable commodity, subject not only to spoilage from the moment of harvest, slaughter, or manufacture, but also vulnerable to attack from a vast array of living things ranging from microbes to insects to rodents and other vermin.

The 1960's and 70's saw an acceleration of the trend to single-person and two-income families, leading to a demand for convenience foods, carry-outs and smaller, individual portions.

The 1980's were marked by a continued trend to convenience, coupled with a concern for health that resulted in a demand for natural foods, and fresh and freshly prepared foods. These trends were accelerated and complemented by advances in food preparation technologies, especially the microwave. Microwave technology alone has been responsible for whole new families of packages that are microwave compatible or microwave enhancing.

Today's consumer can choose from a vast array of food products in serving sizes compatible with their needs. Fresh, frozen, canned, condensed, and dried foods are readily available. All of this is made possible through the combination of modern food processing and food packaging technologies.

Packaging's role in distribution

The distribution system in the United States is an important element in the standard of living enjoyed by American consumers. However, American-style distribution systems exist in only a small portion of the world. Developing counties, centrally planned economies, and even many other economic powers do not enjoy the advantages of the U.S. distribution system.

Packaging is an essential ingredient in modern distribution systems that provide consumers with the products they want:

1. When they want them,
2. At convenient shopping locations,
3. In the quantity (large or small) desired, and

Missing Page

package/product combinations have been developed that resulted in revolutionary changes in the way goods are distributed.

Modern packaging as a direct link between the producer and the consumer

One effect of packaging in modern distribution systems has been its direct linking of the producer and consumer. Producers retain responsibility for their products by putting brand names on the package. Consumers quickly learn to rely on particular brands for the quality they want. The intermediaries between the producer and the consumer the wholesalers and retailers do not determine the quality of the product.

Products which are packaged, but unbranded, are taking up a smaller and smaller portion of supermarket shelf space. Fresh poultry is now almost universally branded. Branded fresh fruits and vegetables are becoming the norm. Other products such as fresh red meats and fish are now also appearing as packaged, branded products.

Packaging and the 1990s quality of life

Today, less than 3 percent of Americans live and work on farms. The fact that these few Americans can feed more than 240 million Americans and millions more overseas is the result of the successful development of agricultural technology and the development of the distribution systems and packaging necessary to avoid spoilage and waste.

At present in the United States, more than 40 percent of households are not traditional married couple families. Of those households which are married couple

families, about 25 percent are families with at least one child and both parents working. These living patterns indicate that, in many households, the traditional family gathering at mealtimes is a thing of the past.

With this pattern of living, conveniently packaged foods are essentials, not luxuries. Further, they are cost effective. A study at the University of Maryland showed that "convenience packaged foods are slightly less expensive that prepared-from-scratch fresh foods, without accounting for the savings in food preparation time".

Customers today demand more and more value from the grocery products they purchase. However, what constitutes value often adds up to various combinations of quality, convenience and price.

Packaging reinforces this perception of value by preserving food quality, securing the safety of pharmaceuticals, and providing convenient reclosability, opening and removal of personal care and household products.

While value for money rates high for all product categories, consumers believe they are paying more for packaging today than five years ago. Resealability-one of several convenient consumers expect when they buy packaged goods-is considered a slightly more important package trait than easy opening (Fig. 2-1). Reclosability is particularly more important for OTC drugs.

Packaging offers the food industry a marketing tool that is most useful in the growth and promotion of sales. In principle, the product and its package are an integrated unit. A moisture and /or oxygen-sensitive food product requires a package with adequate barrier properties. A high-acid, hot-filled food product requires a sanitary can with the proper

lining material. Product development and package development should be conducted simultaneously and interactively. This could even include the changing or reformulating of a food product in order to make it easier or more economical to package.

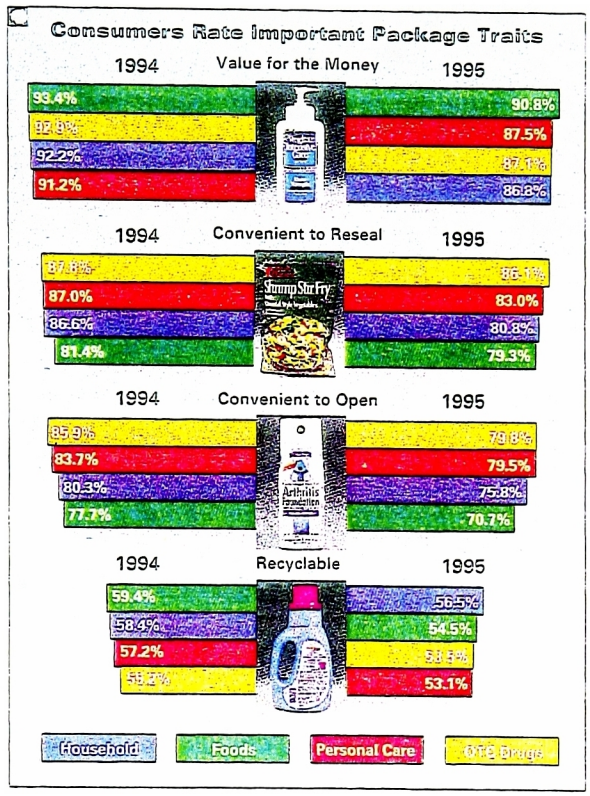


Figure 2-1 Consumer rate important package traits[6]

The increase of the food industry to meet the population growth of the country was naturally followed by an expansion in the field of packaging. Of course, the packaging requirements for drugs, pharmaceuticals, hardware, personal care items, etc., also increased rapidly. The growth rate of packaging closely followed the growth of the Gross National Product over the past 30 years. (Fig. 2-2).

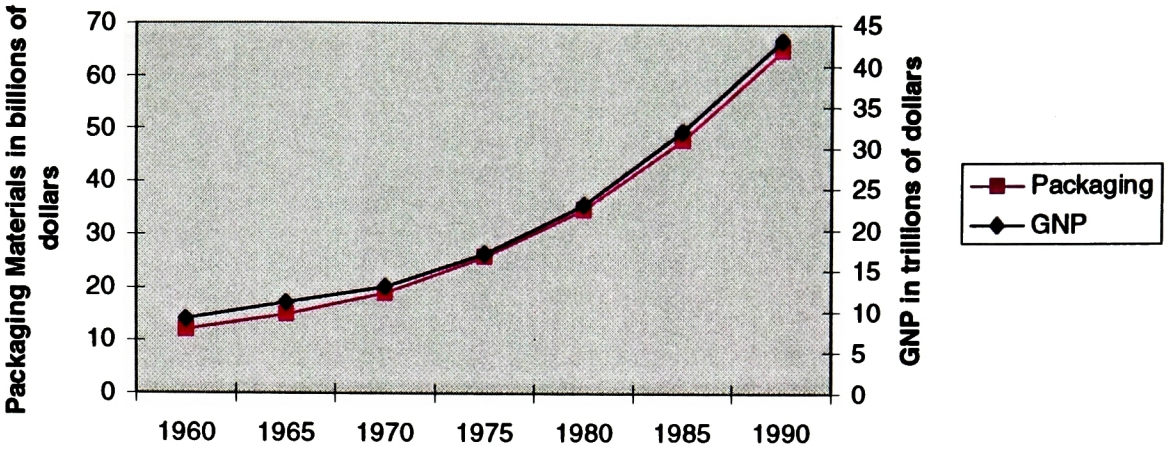


Figure 2-2 **GNP and growth of packaging in USA**[7]

In fact, at year end, one of the leading national business magazines, Forbes, in the 9 January 1989 issue; treated packaging as an industry unto itself. Packaging was included when it reported trends and forecasts for major industries such as food, steel pharmaceuticals, electronics, and other industrial segments.

Aluminum has become a very successful packaging material used for beverage cans and foil laminations. Technological breakthroughs in metals, glass, paperboard, composites, laminations, and especially plastics are providing a multitude of opportunities for improved food packaging (Fig. 2-3).

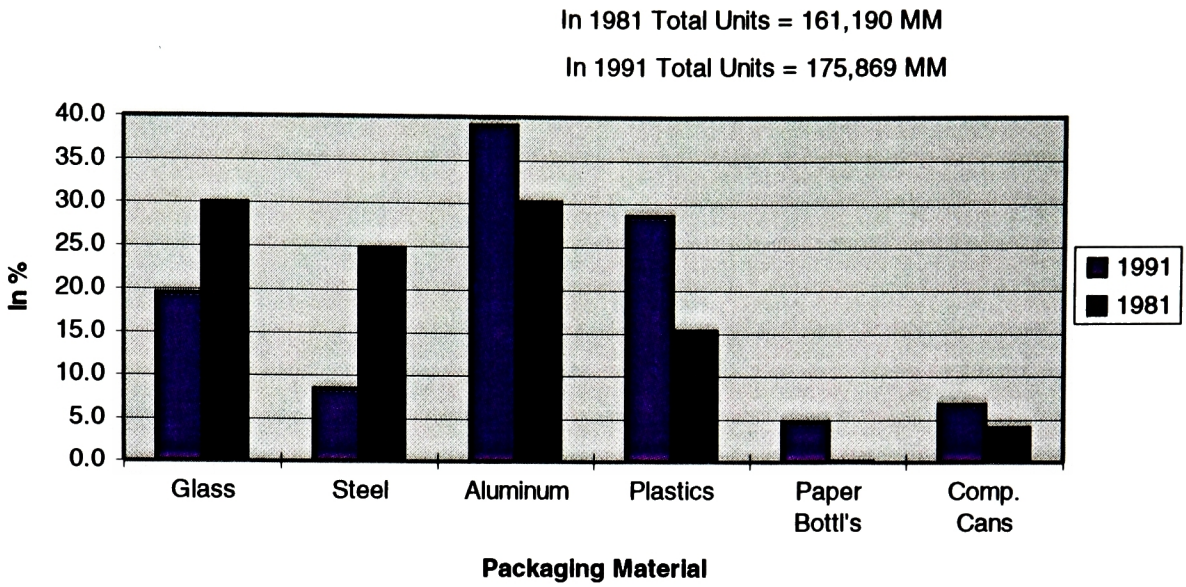


Figure 2-3 **All containers by material**[7]

The major catalyst for packaging advancement has been the plastic materials rapidly being developed. The plastics segment of the packaging industry has shown the most rapid growth for many reasons (Fig. 2-4). Some of the most important are that:

1. plastics have a wide range of physical and barrier properties;
2. plastics offer design capabilities and features not available with other packaging materials, and, more recently, and
3. some plastics can be used in microwave ovens.
4. Plastics can also be used in combination with coextrusions, which offer economic advantages.

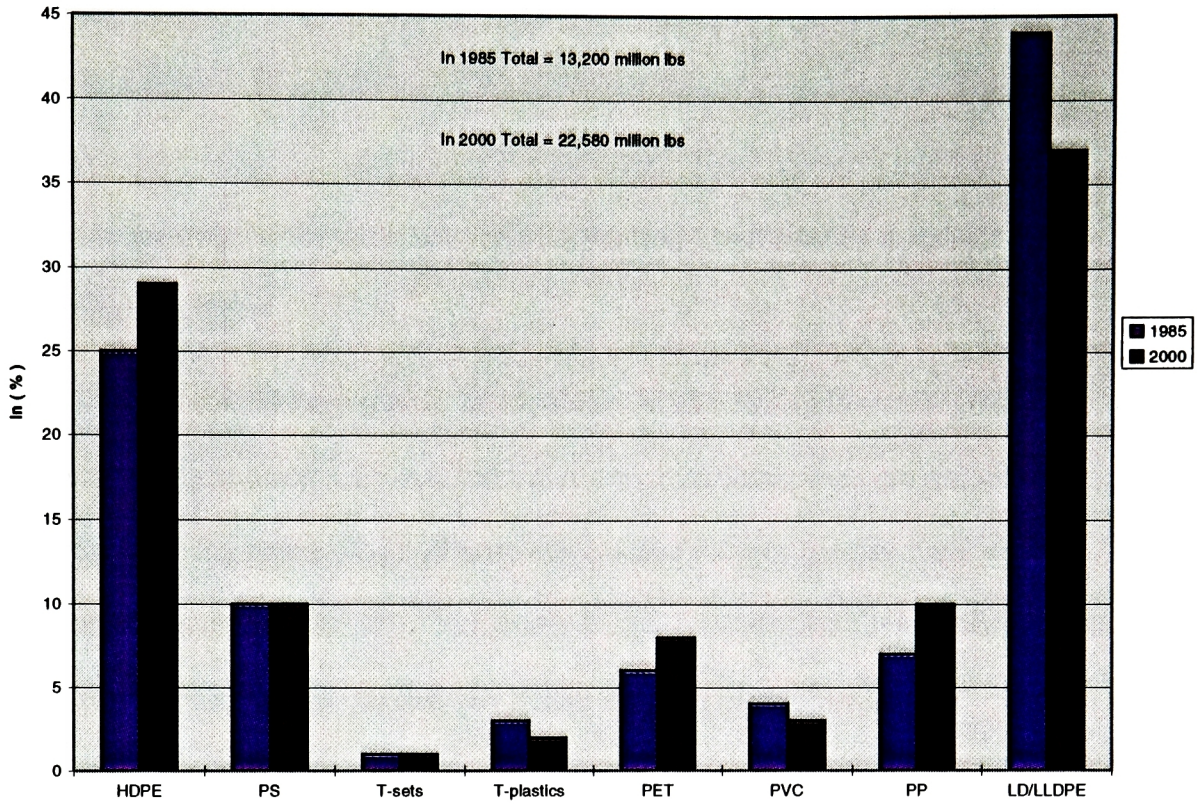


Figure 2-4 **Plastics in packaging in USA**[7]

The opportunities for food packaging today are astronomical. The development of containers and packages is rapid and diverse to allow the food industry to meet the marketing demands of its consumers. One major food company, the Campbell Soup Company, uses steel cans, aluminum cans, glass jars, as well as bottles, aseptic cartons, PET (polyethylene terephthalate) bottles, dual-ovenable CPET (crystallized polyethylene terephthalate) trays, microwaveable polypropylene trays and bowls, paperboard and fiber trays, just to name a few. The company seems determined to give its consumers the packaging options they want, and their wants are many and varied.

In today's intensly competitive food marketplace, a successful food package must function in a way that enhances convenience of use for the consumer. The challenge for food processors and packaging suppliers is to find ways to adapt established convenience features to various types of packages. Thus, consumer convenient packaging seems to be one of the major **marketing** considerations in today's food packaging industry.

Another convenience feature, recloseability, is now finding its way beyond traditional rigid containers such as metal coffee cans with plastic overcaps and into the flexible pouch / bag type package. The development of " zipper pouches " and on-line application systems has provided a recloseable feature for such products as cereals, lunch meats, snack items, candies, cheeses, dry pastas, rice, and many other items.

Consumer research shows that single portion packaging is much more important to consumers than it was a few years ago. Associated with portion packaging is the convenience feature of portability so that food products can be taken to school or to work and may even be microwaved in the package. The portable portion package must provide adequate protection during storing and handling, along with a convenient shape and light weight.

Some of the convenience features, such as single-serving portions, portability, reclosability, and tamper evidence, are in direct conflict with the growing problem of **solid waste management.** Package design and choice of materials are now strongly influenced by the solid waste crisis in this country. Environmental concerns could well

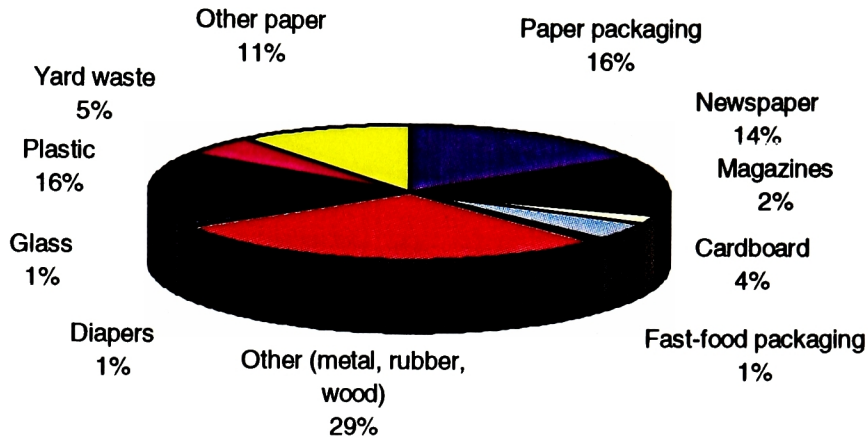
become the packaging quality most selected by consumers in the 1990s. Even now, growing number of consumers are willing to pay more for more-recyclable products. The data from U.S. Environmental Protection Agency (E. P. A.) indicate that plastics are really a very small portion of municipal solid waste (MSW) (Fig. 2-5). Currently, only 1% of plastics are recycled versus aluminum's 54%, papers' 30%, and glass' 25%. However, major efforts are underway by plastics companies and users to develop means of source reduction and recycling.

Besides source reduction and recycling, there are other two means of disposing of solid wasteland fills and incineration. All four methods will have to be considered to resolve the solid waste problem in this country. Thus, it appears that in the future, package design will be shaped at least in part by solid waste considerations.

As paper and paperboard, metal, and glass packaging waste **increases** in solid waste, food waste **declines**. As **plastic wastes increases** in the U.S., the amount of **food waste decreases** at an greater rate.[7]

It is sometimes claimed that municipal solid waste can be substantially reduced by consumers if they would buy only large portions and " large economy sizes " of food, but lifestyles and demographic trends, however, point toward the need for **smaller** portions and individual servings for many consumers.

By volume



By weight

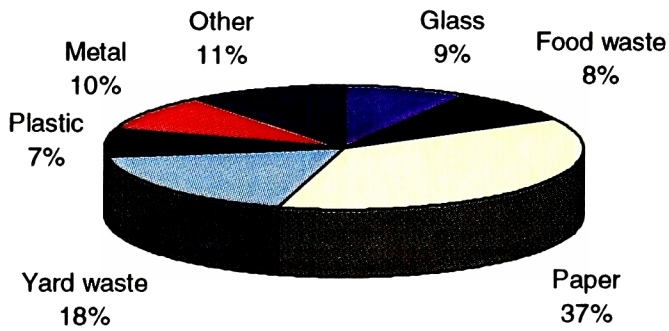


Figure 2-5 **Contribution of packaging materials to solid-waste in USA**[7]

In 1989, the Environmental Protection Agency issued its recommendations concerning methods to solve the MSW problem. For the packaging position of MSW, the EPA recommended a hierarchy of solutions, in the following order:

1. source reduction
2. recycling
3. incineration (waste-to-energy)
4. landfill

Many government actions are pointed toward reducing or controlling solid waste costs through reducing some part of the packaging component of waste. It is popular to give solid waste cost figures for a municipality or region and to state that a cost reduction can be achieved that is directly proportional to the weight or volume reduction that might be achieved through eliminating certain packages. Since all packaging makes up about 30% of MSW by weight or volume, eliminating of whole categories of packaging waste would not likely be transferred into meaningful cost savings.

The main principles of logistics in the USA

The logistics concept embodies the idea that materials and products flow through the organization, from a source through production to distribution to customers or users. The process involves many functions and organizational activities, and may include external operations also. The concept is oriented toward the objective of managing this flow as a single integrated unit.

The concept is important today because of the development of both technology and a new management perspective. Technology includes not only transportation, inventory, and material handling, but information and the ability to use it to direct and control a complex system.

Products consumers use are the result of the process in which materials move from raw materials through production and distribution to become available to buyers and consumers. Logistics describes this movement of material and products from source to production, and from production to the market. Logistics activities are so commonplace that they are taken for granted.

The purpose of logistics is to overcome time and space. Management's challenge is to direct, plan, and control the material and product flow as one integral unit by coordinating the activities of the firm, and even external organizations involved in the product flow.

Each corporate supply and distribution system contributes to the social process of allocating products. It requires public investment in the infrastructure of highways,

harbors, telecommunications, and other areas of common service. The total costs to society in both public and private expenditures are very great, and also unavoidable.

These are compelling reasons to become concerned with logistics management. Logistics management, however, would not be feasible without the logistics concept. This system-oriented form of management permits managers to group separate but related activities together in a centrally coordinated arrangement to achieve a common end.

The recognition of this concept has been relatively recent. Only in the last 25 years has management begun to use system concepts to direct the flow of products through the organization. It treats activities such as transportation and inventory as both separate functional management areas and as interrelated elements in a common system. It solves problems by using the complex methods of systems analysis and other computer-supported solution procedures. More importantly, it alters traditional management perceptions of the nature and boundaries of the logistics system.

The logistics concept embraces two central ideas: product flow and the system trade-off. The roots of these ideas can be traced to writers in the nineteenth century. The system trade-off was described by a French economist, Jules DuPuit, in the early nineteenth century, comparing the costs of transportation by carriage and canal barge to differences in transit times and inventories.[8] Business itself developed along functional lines. Product flow decisions were separated into transportation, inventory, and production with little consideration of their collective impact. .[8]

In the 1930's, the emergence of motor carriage and an increasing sophistication in business encouraged a few companies to investigate the problems of physical distribution. In exceptional cases, transportation and warehousing were placed under the same control.

The earliest applications of the computer to business included logistics applications: vehicle routing and scheduling, inventory control, location analysis, and documentation.

These specialized tasks are important to management of logistics operations, but their solutions did not emphasize the integration embodied in the logistics concept.

The computer now serves three roles in the organization: processing transactions, establishing unified control, and permitting global analysis of the system as a unit. In its transaction role, the computer gives the logistics system the ability to handle large volumes of repetitive, low-level calculations, to perform operations, to record them, issue instructions, and store the results on a scale otherwise impossible. This same data provides the basis for control over operations across the entire corporate organizations.

The challenge of logistics management has attracted interest in the development of integrated mathematical decision models of increasing sophistication. The result extends the perspective of management over a wider domain. It creates a new style of management, one that relies on automation wherever possible to process routine transactions, and utilizes global reporting systems and integrated systems analysis. The

emphasis is on planning; operations, the previous focus of management's attention, becomes the result.

The logistics concept began with a marketing orientation, during a period of expanding demand which assumed unlimited resources. Events during the 1970's however, forced an abrupt shift in this perspective: periodic material shortages and uncertainties of demand demonstrated that the traditional approach was one-sided. Interruptions in supply and abrupt swings in price forced managers to secure, allocate, and control supply in order to maintain distribution.[8]

The need to manage supply and distribution as a single unit has resulted in expanding logistics management to include supply, in order to coordinate production and procurement with marketing and distribution. Management of this extended system requires more than operational coordination; planning must take both parts of the system into account at the same time.

The logistics environment has been disturbed recently by several different types of changes. Supply uncertainty is only one. Technological change is occurring in information processing, material handling, and transportation. The costs of fuel and capital, among the most important inputs to logistics decisions, continue to fluctuate widely. Management must develop a comprehensive response to these changes through strategies that embrace the entire logistics system. Logistics management lies in the heart of organization because it provides solutions to problems which threaten the central activities of the organization, the production of products and services.

Application of the logistics concept presents an opportunity to reduce costs and provide the services the market requires.

Defining Logistics

The term business logistics takes its meaning from two ideas, the flow of materials through an organization toward the market, and the process of balancing activities to achieve management objectives of efficiency and effectiveness. Logistics is like a pipeline. It begins with materials and component parts, which become inputs to a production process. Finished products emerge from the end of the process to be distributed to customers.

Petroleum is perhaps the easiest product to visualize. Crude oil is extracted from wells, collected, and shipped via pipeline to a refinery. Here it is converted into a set of products: gasoline, jet fuel, diesel, petrochemical feedstocks, and others. Each moves further toward its own individual market. Gasoline may flow through a product pipeline to a distribution point where it is stored in tanks in anticipation of demand. It is then loaded into tank trucks for transportation to local retail stations, where it is again stored until it is purchased by consumers.

Business Logistics can thus be defined as the activities involved in the flow of materials and products from a source of supply to a point of final consumption.

The concept incorporates three important aspects:

1. Logistics spans the entire set of activities involving material flow from source to market. The purpose of these activities is to overcome time and space. Ordinarily it

does not include production operations, but production decisions are closely involved in logistics decision and operations.

2. Logistics involves activities which interact with each other. The output of the logistics system depends on the effect of specific combinations of inputs. The total cost of moving oil includes both the costs of storage and the pipeline, but the amount of storage capacity needed may depend on the pipeline's size and speed of delivery.

3. Logistics activities reach beyond the boundaries of any one organization. The capacity of the oil distribution system depends on the rate of demand for products and the capacity of individual stations. The premise of the logistics concept is that all of these activities can be managed as an integrated system.

Scope of business logistics

Logistics is a collection of management activities that are repeated many times through the channel which raw materials are converted into finished products. A schematic representation of a product flow channel for automobiles is shown in Fig. 3-1.

Elements of the logistics system.

The activities presented below represent a maximum list likely to be found in the logistics function. It may be divided into key and support activities, along with some of the decisions associated with each activity. A single firm is not generally able to control its entire product flow channel. For practical purposes, business logistics for the individual firm takes on a narrower scope than that shown in Fig. 3-2.

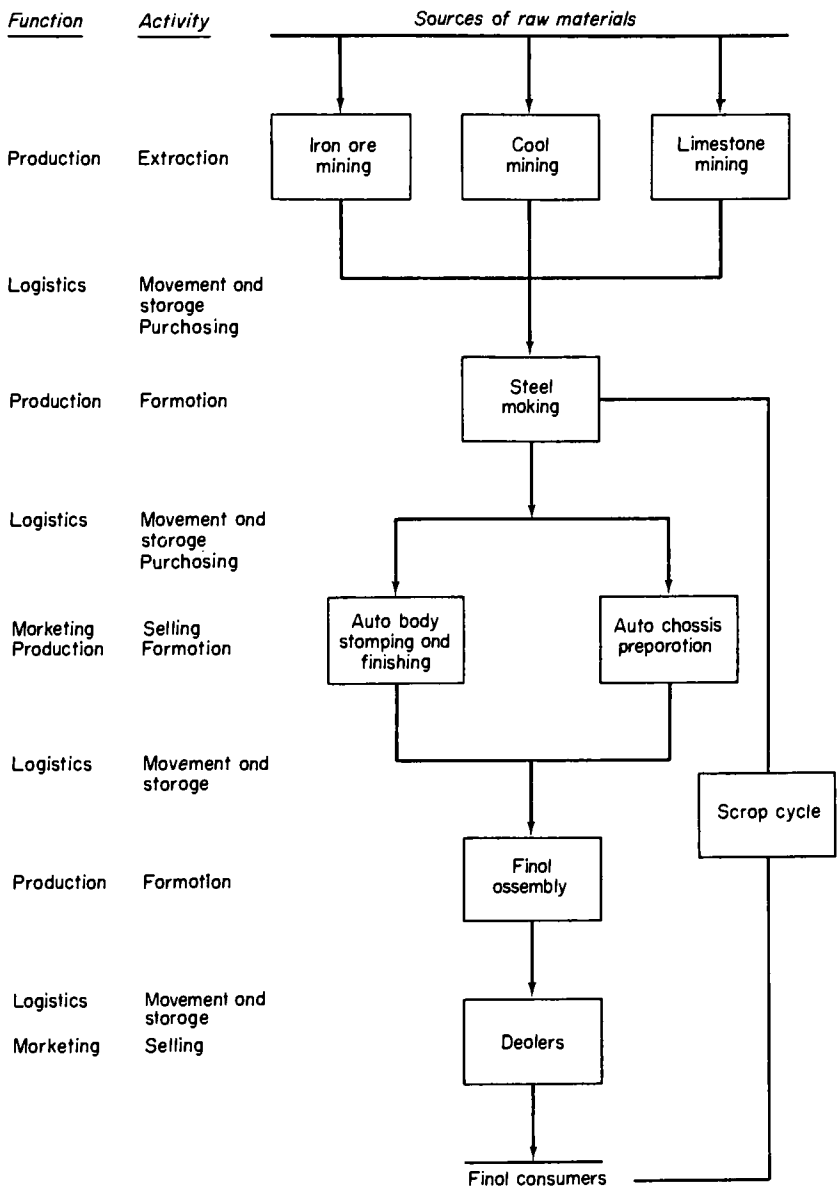


Figure 3-1 **A Product flow channel for automobile production**[8]

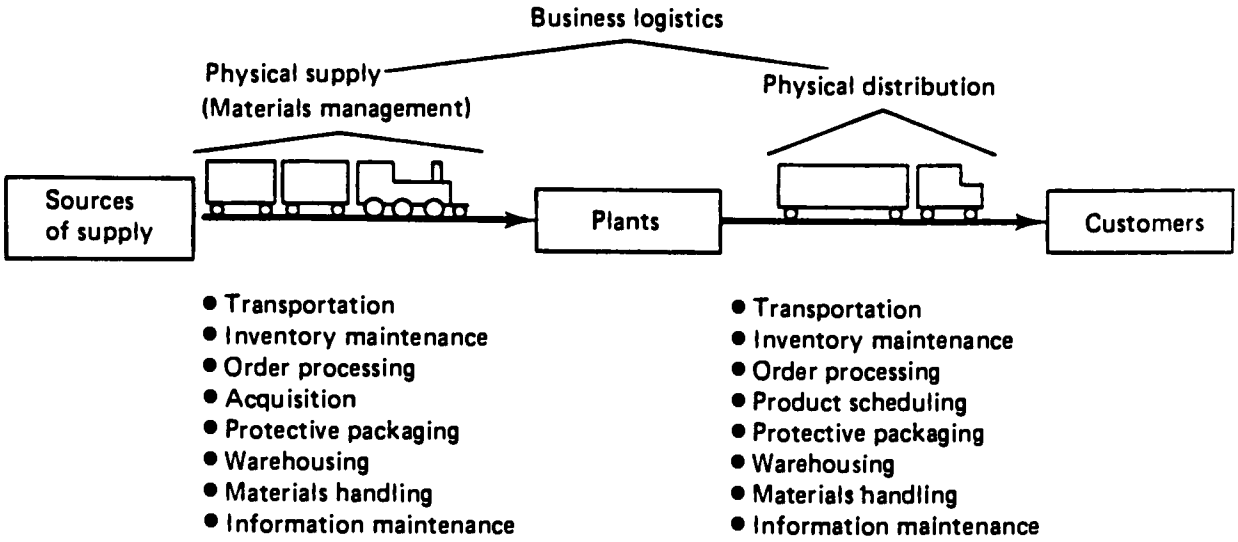


Figure 3-2 **Scope of business logistics for the individual firm**[8]

Key Activities

1. Customer service standards

   Cooperate with marketing in

   a. Determining customer needs and wants for logistics service

   b. Determining customer response to service

   c. Setting customer service levels

2. Transportation

   a. Mode and transport service selection

   b. Freight consolidation

   c. Carrier routing

   d. Vehicle scheduling

3. Inventory management

a. Raw materials and finished goods stocking policies

b. Short-term sale forecasting

c. Product mix at stocking points

d. Number, size and location of stocking points

e. "Push" vs. "Pull" strategies

4. Order processing

a. Sales order-inventory interface procedures

b. Order information transmittal methods

c. Ordering rules

Support Activities:

1. Warehousing

a. Space determination

b. Stock layout and dock design

c. Warehouse configuration

d. Stock placement

2. Materials handling

a. Equipment selection

b. Equipment replacement policies

c. Order-picking procedures

d. Stock storage and retrieval

3. Acquisition

a. Supply source selection

b. Purchase timing

c. Purchase quantities

4. Protective packaging design for

a. Handling

b. Storage

c. Protection from loss and damage

5. Product scheduling cooperate with production

a. Specifying aggregate quantities

b. Sequencing and timing of production

6. Information maintenance

a. Information collection, storage, and manipulation

b. Data analysis

c. Control procedures

Fig. 3-3 shows the major functional elements are considered part of the logistics system because they directly influence each other's performance.

A central core of logistics functions is involved in supplying products: order processing, inventory, and transportation. They are identified as **primary activities**.

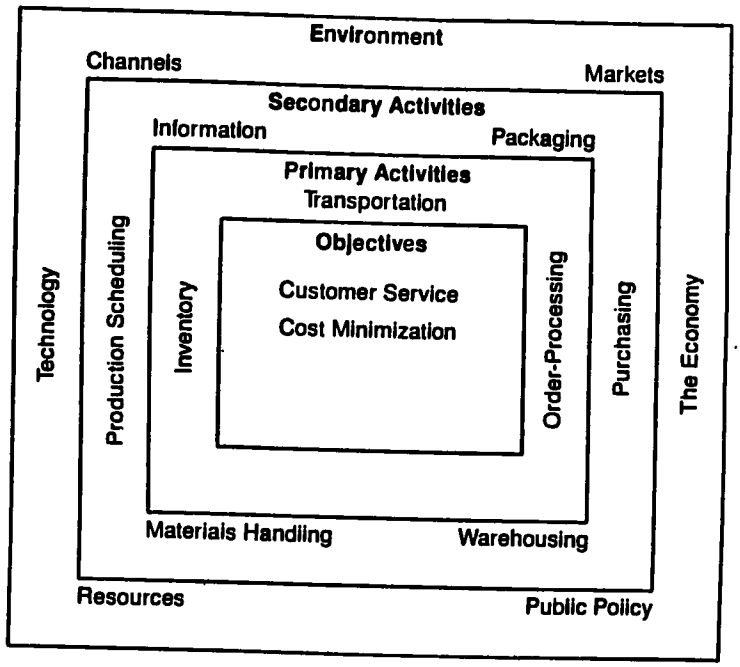


Figure 3-3 **Logistics activities and environment**[9]

Primary Activities.

Transportation includes both inbound transportation from suppliers to the production line or distribution center, and outbound transportation from the production line or distribution center to the customer.

Inventory includes both finished goods and process materials, wherever they are located within the product flow.

Order processing involves the communication from the customer to the seller to initiate the activities that lead to the completion of the order.

Secondary (Supporting) Activities.

Distribution center management, or **warehousing.** Refer to the storage function where inventory is maintained. The function involves internal operations and planning activities to use space for storage and movement.

Material handling is the movement of inventory within organizational facilities, as within the distribution center, or between receiving inventory and using it in the production line.

Packaging involves decision about the type and degree of protection for products and materials moving within the system. Specific considerations include protection in storage, ease of material handling, identification, and the cost of movement.

The Logistics Environment.

The performance of logistics systems is also influenced by specific environment factors and trends. They influence management decisions which change the long-term direction of the system. The most important are:

1. **Market and customer.** Patterns of demands, geographic locations, and service requirements.
2. **Distribution channels.** Determine which activities must be performed in-house or by external organizations.
3. **Product characteristics.** Determine the channel logistics required to deliver the products to market, such as controlled environment for frozen food, and cost of movement, storage, and handling.
4. **Technology.** Describes a variety of logistics processes: transportation, material handling, communication, order processing, computer-based information systems, packaging, and distribution center operations.
5. **Public policies.** General policies, such as antitrust law, and more specific policies directly related to logistics.

6. **The economy.** Influences demands for products and the intensity of completion for markets.

7. **Resources.** Influences logistics decisions, including energy costs which determines the relative cost of transportation.

Logistics Management

Logistics management can be defined as the planning, operation, coordinating, and controlling of the activities and resources involved in the material (product) flow from source to the final customer. The most distinguishing characteristic of logistics management is its emphasis on the direction of a process in motion, pausing momentarily for production or storage processes in anticipation of or in response to orders from customers. The direction of the flow is toward the point of final consumption. At the same time, the activities are directed by information, initiated by customer orders, that provides coordinating signals that progress backward toward the source of supply.

The breadth of activities involved requires coordination among the organization's marketing, distribution, production, and purchasing. It may also involve coordination with outside organizations, including customers, suppliers, and transportation carriers. Organizationally, logistics tends to emphasize the span of control rather than control over separate functions.

The system concept

The flow process emphasizes elements of each perspective simultaneously. The key to defining a system is interaction; those elements that interact with and influence each other are part of the system.

The significance of logistics in the USA

One measure of the significance of logistics to business lies in costs that it incurs. Costs vary depending on the type of business, the operations it performs, the products it produces, its markets, and its volume of business.

Specific data for manufacturing and merchandising (wholesaling and retailing) firms were collected by LaLonde and Zinszer. Their data, shown in Fig. 3-4.

If logistics costs are a substantial part of the cost of doing business for individual firms, they should be even more to society as a whole. At each stage of the material flow, costs of transportation, handling, storage, and management are incurred accumulate in the final price of the products that are bought, even though these costs are borne by the ultimate consumer.

Considering the economy as a whole, logistics costs have been estimated at 15 percent of the gross national products (GNP). If services are dropped out of GNP as irrelevant to logistics costs estimates, logistics costs become approximately 23 percent of the tangible gross national products. Of these costs, movement costs represent roughly two-thirds and inventory holding costs one-third. These cost levels in percentage terms have held constant since 1950.

Industry	Trans.	Invt. Carry.	Whsg.	Adm.	Rec.d Shp.	Pkg.	Ord. Proc.	Total* Cost
Manufacturer								
Chemicals and Plastics	6.3%	1.6%	3.3%	0.3%	0.6%	1.4%	0.6%	14.1%
Food Manufacturing	8.1	0.3	3.5	0.4	0.9	—	0.2	13.4
Pharmaceuticals	1.4	—	1.2	0.7	0.5	0.1	0.5	4.4
Electronics	3.2	2.5	3.2	1.2	0.9	1.1	1.2	13.3
Paper	5.8	0.1	4.6	0.2	0.3	—	0.2	11.2
Machinery and Tools	4.5	1.0	2.0	0.5	0.5	1.0	0.5	10.0
All Manufacturing Companies	6.2	1.3	3.6	0.5	0.8	0.7	0.5	13.6
Merchandiser								
Consumer Goods	8.1	8.5	4.0	1.3	0.9	0.9	0.5	24.2
Industrial Goods	5.9	13.7	2.9	0.7	0.2	2.0	1.0	26.4
All Merchandising Companies	7.4	10.3	4.2	1.2	0.6	1.2	0.7	25.6

*Recognized by more than 30% of all firms.

Compiled from: Bernard J. LaLonde and Paul H. Zinszer. *Customer Service: Meaning and Measurement* (Chicago: National Council of Physical Distribution Management, 1976), Chapter 3.

Figure 3-4 **Distribution costs as a percentage of sales dollar**

It is also estimated that about 19 percent of the national wealth is invested in logistics activities, and these activities employ 13 percent of the work force.

Other countries are also experiencing high costs for physical distribution. In the United Kingdom these costs are estimated to be 16 percent of sales, of which 5.5 percent is for transportation. Japan, on the other hand, has physical distribution costs of 26.5 percent of sales, with 13.5 percent represented by transportation costs. Australia has estimated average physical distribution cost of 14.1 percent., of which 2.5 percent is for transportation. Thus, other countries have experienced physical distribution costs in line with those of the United States, even though the relative costs of the individual activities vary substantially from country to country.

Contemporary issues and trends in logistics in USA

The past decade has brought a lot of changes, further focusing attention on managing logistics as a process rather than a series of individual activities such as warehousing, transportation, and inventory management. Heightened global competition - especially in the food distribution industry - has forced companies to consider world-wide alternatives for sourcing, manufacturing, distribution, and selling their products.

Companies now develop strategic alliances with consumers and supplies in order to align resources and harmonize operations more effectively. In addition to the creation of partnerships among supplies and customers, it is expected that " designer logistics " will become standard. " Designer logistics " means a logistics system specifically designed to meet the needs of an individual customer.

Third-party service providers have also emerged as alternatives for in-house transportation, warehousing, and inventory management functions. And the logistics concept- managing sourcing/purchasing, materials management, and physical distribution as a single business process- has gained broader acceptance throughout industry.

Companies that have had major successes in quality and productivity improvement share common characteristics. Motorola, Xerox, Hewlett-Packard, Milliken, Federal Express, Dow, Texas Instruments, IBM and others led the quality movement in the United States during 1980s.

Future improvements in logistics will come from nontraditional areas. Traditionally, improvements to logistics performance have been measured in terms of cost reduction or productivity gains. The primary sources of these kinds of

improvements were transportation and warehousing. Instead companies will look to purchasing, materials planning and control, and information systems as sources for future productivity gains from logistics. Benefits will come in the form of reduced inventories, more efficient production, more effective purchasing, fewer errors, more streamlined and accurate information flow, and less duplication and waste effort.

On the service side, actual on-time delivery performance in 1985 averaged 81 percent across the companies, in 1992 everaged 92 percent. And 97 percent was what companies expect by 1997.

The move toward common markets and need for firms to have a significant " presence " in markets within which they compete will impact decisions concerning the location of research and development, manufacturing, assembly, and logistics. Because of the role of logistics in firm's competitive position, location decisions will weight more heavily the contribution of logistics to market share and profitability.

Just-In-Time (JIT) as part of contemporary logistics

JIT's fundamental concept of supplying what is needed only when and in the quantities needed is the philosophy of small and large lot production. In a word, the high speed and continuous production of a single product directly conflicted with method advocating the reduction of cost and lead time. It is the idea of manufacturing a wide variety of products in only the quantities demanded by the market and utilizing a more flexible system to meet the need of diverse customers while extracting maximum human ability, experience, and creativity from workers.

Frederick W. Taylor is the father of scientific management. At the end of the nineteenth century and the beginning of the twentieth, management methods emphasizing efficiency began in the United States and spread throughout the world. According to Taylor, the barriers to manufacturing efficiency were that:

1) the workers performed systematic sabotage and

2) the methods used to determine wages were irrational.

As ways to rationally and scientifically establish wages, Taylor performed time studies and task management. Through these he was able to establish standard operations and to control the time of production activities based on these criteria, and the concepts of "standardization" were born.

The "Ford System" of Henry Ford mechanized Taylor's time-based control of operations. It was Ford who conceived the conveyer-driven production lines. These

production line methods were the driving force behind dramatic improvements in the manufacture of automobiles at the time. Just-In-Time (JIT) manufacturing is not a Japanese technique being adopted by U.S. companies. It actually began in America some six decades ago. Using an integrated process, Henry Ford converted raw iron ore into finished automobiles in less than 48 hours. He treated the entire production network as though it were one long production line.

To enable JIT, the concept of " business as usual! " will have to be addressed. Every phase of the processes must be re-examined, rationalized and simplified. The result must be more stable processes that output higher-quality, lower-cost products on demand. JIT may be the best strategy to meet today's challenges because it can enhance the effectiveness of manufacturing resources planning and computer integrated manufacturing through simplification.

Main principals of JIT

Just-In-Time manufacturing is a process that allows effective machine production and component supply in integers of " one "; i.e., no " buffers " anywhere from suppliers to manufacturing to customer. Implemented successfully, it will improve space, equipment, material, and human resource utilization and help realize quality, cost, and delivery goals.

JIT principles and enablers include:

1. Continuous Improvement
2. Employee Involvement/Leadership Through Quality/Total Quality Control
3. Focused Factories
4. Group Technology

5. Design for manufacture

6. Setup Reduction

7. Uniform Scheduling

8. Pull Systems (material replenishment driven by consumption)

9. Close Supplier Relations

10. Transport Innovation (frequent, predictable delivery of small quantities to the point of use)

11. Management Participation

12. Continuous Processes

13. Minimal Inventory and Work in Process

14. Clean/ Open Work Environments

The Toyota Production System is based on the assembly line or work flow system. The difference is that Toyota eliminated the warehouse. "Just -In -Time" is having the parts needed, in the amount and at the time needed. Taichi Ohno, the father of Toyota Production System and former vice president of the Toyota Motor Company, originated the just-in-time (JIT) production concept of "supply the market with what is needed when it is needed and in the exact quantities needed". It not only turned Toyota into a colossal super company, but also turned Japan into a world-class manufacturing power.

In markets based on the principles of competition, the main objectives of the manufacturer in any age have always been to make higher quality products less expensively and more quickly. In situations typical of those found before the first oil

shock , where the supply cannot keep up with the high income people, material, and capital to increase production even slightly, then lower average costs and increased profitability would result. To make things inexpensively, a company must make high quality products in just the amounts that will sell, using few people and inexpensive equipment.

JIT training is training in practical experience following four basic steps: 1) taking hold of basic thinking; 2) based upon that, giving guidance in methods and techniques; 3) trying those methods and techniques and ascertaining results; 4) doing it yourself. The strong point of a system like JIT is its simplicity. The methods and techniques can be grasped easily by the workers on the job, and the results are likewise "in the hand" and easy to understand. Before JIT, no such simple, easily understood methods existed for management (or factory) improvement. There is little doubt, however, that the best training is in the workplace where anyone can try the methods and ascertain their results.

The essential feature of JIT manufacturing is the concept of waste, of defect prevention, of quality at the source. Today, quality is no longer defined by acceptable levels of scrap, nor is it to be inspected by sorting good from bad at the end of the manufacturing process. To a proponent of JIT manufacturing, then, waste is defined as any unneeded, nonvalue-adding activity at any stage in the production cycle.

This concern with waste is based on the use of time, time being the one element all aspects of the manufacturing process, including back office activities, have in common. Every activity uses time. People are paid for renting their time to the

organization. And inventory is a store of time, time to completion. No completion, no revenues, and no money to pay for more time.

JIT is an enterprise- wide operating philosophy that has the elimination of waste as its basic objective. As noted by Dr. Chou, a renowned JIT expert, " Waste is considered anything other than the minimum amount of equipment, materials , parts, space and workers' time absolutely essential to add value to product. " The key phrase is "adding value." JIT strives to identify activities that do not add value and eliminate them.

Reusable packaging

Today, environmental issues and cost-reduction requirements are once again bringing returnable containers back into the limelight. Recent reports indicate dwindling waste-disposal space, pollution of ground water, global warming, depletion of the ozone layer, and deadly dioxins caused by incineration.

Although returnable containers have been around in various shapes and varieties for hundreds if not thousands of years, they were a relatively late addition to much of American industry.Early returnable containers, sized for rail delivery, were largely made of wood or metal. More recent containers, sized for truck delivery, are made of wood, metal and high-strength plastics.

The benefits of returnable container programs in the automotive industry have been both clear and substantial.

There are three general areas of program benefits.

1. Cost savings. Typically, the payback on the physical containers is one to two years. Combine that with the projected life of returnable containers (10 + years) and the result is eight or more years of no container costs. And that is just the initial cost savings.Stronger, better designed returnable containers protect your products better. Reject rates drop. And piece part prices drop thanks to lower packaging costs, greater operational efficiencies and less product damage. Further, better ergonomically-and

anthropometrically-designed containers cut handling costs, compensation claims and worker complaints.

2. No waste to dispose of. Sometimes corrugated scrap can be sold, and sometimes it must be paid for to have it hauled away. In either case it costs money in handling, bailing and recycling operations. It takes up space withiin the plant and very often in expensive (and rapidly closing) landfills. As environmental regulations are toughened and landfill prices increase, reusable, recyclable containers will become even more appealing.

3. Improved vendor/manufacturer relationships. By its very nature, a returnable container program demands good teamwork. People must work together to make the program work. If a company is already involved with just-in-time manufacturing,benefits are understood, and it is extremely critical to JIT success.

Implementation of a returnable container program will dramatically change the way a company does business. Returnable containers change the way virtually everyone has to operate. That is going to affect the program's implementation. Returnable container programs are involved processes.

As logical and beneficial as returnable container programs are, they are not for everyone. There must be developed a closed-loop shipping system with a frequent number of shipments to relatively few sites. There must be a way of returning the containers to the parts suppliers cost-effectively.

Questions to ask here include: How are the parts shipped now? Is that how they will be shipped in the future?

What about plant operation? Does an assembly plant use robotics? Is it already committed to JIT manufacturing? Are management information systems people informed and willing to help you up front with developing the data system necessary to effectively track the containers?

Take a good hard look at products and how they are assembled. Stackable? Nestable? Do they have lids, handles, dividers? How much protection does the product require? Is damage a problem? How about contamination? Cleanliness? Weight?

Today, returnable containers are available in everything from wood to metal to super-strong, lightweight plastic. Most supplies offer standard footprints and most suppliers offer special sizes, designs and materials when required. A decision must be made as to how the parts are best protected, transported and presented.

Vendors must be involved. To make the program successful, everyone needs to come out a winner. If a piece part reduction is required from a vendor, make sure the vendor sees "what's in it for him," too. Usually packaging savings alone (when looked at over the life of the containers) are enough to justify the switch.

Handling costs will be down. Part costs will be down. Assembly workers will find them easier to use. Often there are fewer complaints. Transportation people will see the benefits of working with standardized returnable containers. And, data processing people will discover that tracking the containers isn't the problem they thought it might be.

Many companies have thought up creative and successful solutions for reducing and optimizing both product and transport packaging, and if possible also for bringing reusable packaging into the marketplace. Retailers on the other hand reward or penalize the outcome of this by the way they order, because "green" also sells better for them.

Now, "multi-trip not one-trip" is easier said than done, because a proper multi-trip packaging system not only has to be "do-able" but also affordable. In addition it also has to stand up to a critical ecological audit. Multi-trip may be required by the system, but it costs more than single-trip. For a start, the materials are more expensive because they are better quality; then there is additional expenditure on the changeover, accounting for deposits, return transport, washing and reconditioning containers, as well as higher administrative costs. It's little wonder that industry often takes the stand that "Reusable packaging is fine, so long as it isn't any more expensive than disposable!"

So the success of a multi-trip packaging system stands or falls on the match between supply and demand. Some multi-trip pools have already been successfully established or are in the process of being established.

- The CHEP pallet and container pool
- the IFCO fruit and vegetable pool, and
- the MTS container pool for mixed groceries,meat,fish, poultry, eggs, and yogurt to

name but a few examples of foodstuff distribution

In other fields, there is interest in container pools for pharmaceuticals, auto parts, sports equipment, generalhousehold goods, books, and the like.

What are the responsibilities of a multi-use packaging provider?

The methods of action and responsibilities of a provider of a pooling service are both equally determined by market requirements:

- to develop a customized system to suit the specialty
- to design the appropriate containers or pallets
- to obtain the containers required
- to lease out the containers to commercial customers
- to retrieve the empty containers from the shops
- to sort, clean, repair and recycle them
- stock control, planning, accounting, deposit handling.

A good example of this is IFCO. In collaboration with eleven large German retail chains a collapsible, reusable crate was developed for imported fruit and vegetables. This crate is to replace 120 to 150 million disposable boxes every year. One handicap for IFCO was that a single container cycle should not cost more than a comparable disposable container. This was why an entirely new, reusable folding crade had to be designed for fruit and vegetables which on the one hand could be manufactured economically and on the other hand could be collapsed into a narrow space (4 cm) when empty, to keep transport costs to the minimum.

What are the prerequisites for multi-trip systems?

One deciding factor in the successful establishment of a multiple use packaging pool is the distinctive infrastructure of the service provider. Not only does it need a nationwide network of depots and a high-performance computer system networking closely with

depots, drivers and retailers, but a one-way collection system such as this also stands or falls on its ability to collect all the used crates within the region at a reasonable cost and bring them back to the depots as soon as they have been emptied and put ready in the shops loading bay.

It would be neither sensible nor economical if every organizer ran its own delivery and collection system. Apart from the internal staff and administrative costs, every service provider would have to build and sustain its own network of depots nationwide-often in the same locations. Every one would be sending trucks independently, often unloaded, to the same collection points at retailers' promises. The logical solution is the greatest possible concentration and coordination of retrieval logistics by the various pool organizers.

Logistics Benchmarking

Benchmarking is the search for industry best practices that will lead to exceptional performance through the implementation of these best practices. It is the heart of the planning process for any company that holds customer satisfaction as its highest priority. It is an integral part of the Quality process.

Benchmarking is a current topic in management circles. In fact, in a survey Distribution magazine recently conducted among Fortune 1000 companies, 65 percent of the respondents said their firms used benchmarking as a management tool to "gain competitive advantage".[10]

Benchmarking steps:

1. Determine which processes to benchmark.
2. Identify key performance variables that will impact customers.
3. Identify best-in-class companies.
4. Identify practices and measure your own performance.
5. Identify practices and measure performance of partners.
6. Take actions to close the gap.
7. Implement changes identified.
8. Measure results against customer needs and repeat the cycle.

The bulk of benchmarking is going on at the work process level for such functions as order picking, sorting, packing, etc. There are three especially vital areas in benchmarking currently. The area receiving the most benchmarking attention is warehousing because it is quantitative. It is a natural for measurement.

Another area currently of interest is order processing and customer service because it impacts the overall success of the company and has high visibility.

At the lowest level is working-task benchmarking, which covers single logistics activities such as loading trucks, palletizing shipments, scheduling pickups, etc.

The next level is function-wide benchmarking where one looks at all the tasks in a logistics function at once. With warehousing, for example, the manager looks at every operation from storage to picking to order shipping and attempts to improve overall performance. This is probably the type of benchmarking most people in logistics are involved in currently.

The third level is management-process benchmarking, where managers from different functions jointly look at broad issues such as quality, employee motivation and reward systems.

The highest level of non-strategic benchmarking is total-operation benchmarking, where management looks at the entire logistics operation including distribution center, transportation, inventory management, systems, customer service and other elements logistics. If benchmarking truly becomes part of the planning process, it will assure the continuous positive change needed to get ahead of the competition and stay ahead.

Xerox Corporation, known for pioneering a process called competitive benchmarking, led the way in 1979 by demonstrating the power of benchmarking in its manufacturing operations. The company compared U.S. manufacturing costs with those of foreign and domestic competitors. Its study revealed that competitors were selling products at Xerox's cost of producing them. As a result, the company quickly adopted externally set benchmark targets to drive its business plans.

The experience so dramatically turned the manufacturing operation around that Xerox adopted benchmarking as a corporatewide effort in 1981. Today the company includes benchmarking as a key component of its total quality effort and has broadened its benchmarking activities to include analysis of best practices within any industry. Logistics was one of the first business functions to apply benchmarking.

Benchmarking is the continuous process of measuring products, services, and practices against the company's toughest competitors or those companies renowned as the industry leaders. In particular, functions like billing, inventory management,

distribution, and manufacturing are examined. This involves determining how these identified firms achieve their performance levels and adapt their successful strategies.

Although the formal definition has never been changed (because there have been important lessons learned in the pursuit of benchmarking embedded in the wording), the formal definition is not the most straightforward description of what is wanted from teams commissioned to conduct benchmarking. Therefore, an operational definition of benchmarking has been developed. That definition is finding and implementing best practices. In its most elemental terms that is what benchmarking is all about. And benchmarking teams can readily understand what is expected of them from the operational definition.

There are four types of benchmarking :internal, competitive, functional, and generic. Each has specific outcomes and benefits.

Internal Benchmarking

Internal benchmarking should be viewed as a starting point for benchmarking. Internal functions can provide a pilot for conducting benchmarking and may reveal some best practices that can be replicated elsewhere and place the operation on the path to continuous improvement. To conduct effective benchmarking, it is imperative to document the internal work processes. And conducting internal benchmarking has been shown to be the most straightforward way of doing that documentation.

Competitive Benchmarking

Competitive benchmarking is the comparison of the work process with that of the best competitor. This is a necessity to ensure that the practices of the competition are known and to find out how one compares. In addition, comparison will reveal what performance measure levels must be surpassed. At some stage, the gap between the competition and the internal operations must be known to assess the organization's strengths and weaknesses.

Functional Benchmarking

Functional benchmarking is comparing one's work process practices with those of the functional leader, who is often not in the same industry, and with those who are renowned as the best at what they do. Despite different business focuses, comparability can be maintained.

Generic Process Benchmarking

If organization has matured to the point of pursuing a quality initiative, often referred to as total quality management, then generic process benchmarking has been shown to have the greatest return. A different approach to benchmarking has emerged in recent years, namely, the pursuit of benchmarking to improve the basic generic business process on which most business and public organizations base their operations.

Objectives of Benchmarking

The purpose of benchmarking is derived from the need to establish more credible goals and pursue continuous improvement. It is first a direction-setting process, but

more importantly, it is means by which the practices needed to reach new goals are discovered and understood. It is an alternative to the traditional way of establishing targets, namely, by extrapolation of past practices and trends. Conventional goal setting often fails because the external environment changes at a pace significantly faster than projected. The ultimate benefit is that customer requirements are more adequately met because benchmarking forces a continual focus on the external environment.

Packaging as an important part of logistics

Packaging has been responsible for much of modern self-service marketing. Consumer packaging is highly visible, carrying promotional messages and creating the ability for packages to sell themselves in retail stores.

Protective packaging is a support activity of transportation and inventory, as well as of warehousing and materials handling because it contributes to the efficiency with which these other activities are carried out. Acquisition and product scheduling often may be considered more a concern of production than of logistics. However, they also affect the overall logistics effort and specifically the efficiency of transportation and inventory management. Finally, information maintenance supports all other logistics activities in that it provides the needed information for planning and control.

Packaging has a significant impact on the cost and productivity of logistical systems. Packaging operations and the purchase and disposal of packaging materials are among the most obvious cost sources. Packaging affects the cost of every logistical activity. Transport and storage are directly related to the size and density of packages. Handling cost depends on unit loading techniques. Inventory control depends on the accuracy of manual or automatic identification systems. Customer service depends on the protection afforded to products as well as the cost to unpack and discard packing materials. And the packaging decision affects the cost of the entire logistical system. For these reasons, an integrated approach to packaging can yield dramatic savings.

Packaging in generally categorized into two types: **consumer** and **logistical**. Consumer packaging (what consumers take home) is governed by sales and marketing concerns. Logistical packaging is what facilitates product flow during manufacturing, shipping, handling, and storage. Logistical packaging includes shipping containers for consumer goods (which are almost always also in consumer packages), industrial packaging for production-related materials ranging from automobile parts to food ingredients, and institutional packages.

In contrast to consumer packaging, logistical **logistical packaging** involves protection and handling of products while they are in the distribution system. It is described as an integrated approach to protection, transportation, handling and product identification. The broad concept of distribution packaging includes both the self-service consumer package and the package that protects it in transit. The major emphasis, however, is on considerations within the distribution network from the time that the products is produced until its final destination.

There is also a packaging aspect to vehicle loading and unloading, as well as to intermodal containerization. Every factory and/or logistical operation receives and ships logistical packaging; most operations unpack, reconfigure, and repack products, as well as purchase and dispose of packaging materials.

Packaging functions

The functions of packaging are to provide **protection, utility, and communication**. Logistical packaging provides no greater value of its own but adds value only as it functions in logistical system. The amount of protection that a package

must provide depends on the characteristics of product and conditions in the logistical system. The relationship can be conceptualized thus:

Product Characteristics + Logistical Hazards = Package Protection

The relevant product characteristics are those that can be damaged during distribution. Examples include the propensity of food to deteriorate because of improper temperature, oxygen, or moisture or the tendency for furniture to abrade during transit because of vehicle vibration. The hazards of a logistical system depend on the types of transportation, storage, and handling used.

Utility

The utility function of the packaging relates to how packaging affects the productivity and efficiency of logistical operations. All logistical operations are affected by packaging utility, from truck loading and warehouse order picking productivity to transportation and storage cube utilization. Productivity is the ratio of real output to real input:

Productivity = Number of Packages Output / Logistics Input

Logistical productivity is the ratio of the output of logistical activity (loading a truck) to the input (required labor and forklift time). Most logistical productivity studies center around making the input work harder. But packaging utilization and size reduction initiatives easily increase the output of logistical activities.

Communication

The function of communication is becoming more important for logistical packaging as logistical management information systems become more comprehensive. The

packaging symbolizes the product through logistical channels. Correct identification of stock-keeping units, counting, special shipping instructions, and address represent critical data. Packges with machine-readable codes can be utilized to help mechanize/automate the communication function.

Performance specifications for packaging

The functions of packaging - are the basis for packaging performance specifications that outline what the package must do (for example, survive an impact). The specification of performance guides packaging changes that add value and reduce costs.

- The U.S. Department of Transportation has replaced hazardous materials packaging specifications with performance standards based on the UN recommendations on the Transport of Dangerous Goods that do not specify material but do specify package tests. Performance specifications encourage innovation, and innovation results in lower packaging costs.

Within the exception of a limited number of items, such as raw materials in bulk, automobiles, and furniture items, most products are distributed in packages. There are number of reasons why a packaging expense is incurred.

Among them are the following:

- To facilitate storage and handling
- To promote better utilization of transport equipment
- To provide product protection
- To promote the sale of the product
- To change the product density

- To facilitate the use of the product
- To provide reuse value for the customer

Not all these objectives can be met through logistics management. However, changing product density and protective packaging are of concern in this area.

Protective packaging is particularly important dimension of the product for logistics planning. In many respects it is the package that must be the focus of planning, with the product itself of secondary concern. It is the package that has shape, volume, and weight. The product may not have the same characteristics. The point is that if a television set were removed from its shipping carton and replaced with shock-testing equipment, as is frequently done to test for damage during rough handling, the logistician would not treat the shipment differently assuming that he or she did not know of the change. The package gives a revised set of characteristics to the product.

The protective package is an added expense to the firm. There are cost reductions that compensate for the package expense to the firm. There are cost reductions that compensate for the package expense in the form of lower transportation and storage rates as well as fewer damage claims. The logistician brings theses costs into balance while working closely with sales and engineering to achieve the overall objective for packaging.

The broad concept of distribution packaging includes both the self-service consumer package and the package that protects it in transit. The major emphasis, however, is on considerations within the distribution network from the time that the product is produced until its final destination.

Packaging is a major cost in business, although estimates of the total cost vary. One estimate for distribution packaging alone in 1974 was more that $25 billion. The significance of packaging is not the magnitude of these costs alone, but their impact on other areas. Packaging decisions must be compatible with a variety of management objectives and it is not amenable to the accepted management rules.

System relationship in packaging

As products move through the system, their packaging is part of the material handling system. From the factory to the Distribution Center, the preferred practice is to ship in unit loads. The DC may ship in unit loads again, cases, or broken lots depending on order requirements and company policies. The package at each stage becomes a component of the handling unit. Packaging decisions are affected by more than material handling and protection considerations. Marketing practice becomes important in specifying the type of consumer package, the order quantities accepted, and the preferences of intermediate buyers. The complex problems of packaging can only be solved by applying so called "total package" concept: "The ultimate goal is to develop a package that optimizes service, cost and convenience factors for all elements in the marketing and physical distribution system. In its broadest approach, distribution packaging begins with the design of the product and ends with reuse or disposal of the package." The total package concept is shown Fig. 4-1.

Packaging fails as a system if it does not solve problems and meet objectives at each stage in the distribution process. For example, pet food manufacturers' practice of shipping pallet loads of large bags to customers creates display problems in

supermarkets. The bags that arrive are often damaged, unsightly, and/or infested, leading to product loss. Another problem is the manufacturers' failure to consider retail shelf dimensions. Partial cases are at the least inconvenient, and may result in loss of control over inventory and multiple handling within the retail store. Still another problem is created when package sizes do not match pallet dimensions. This is a particular problem in automated facilities, which lack flexibility.

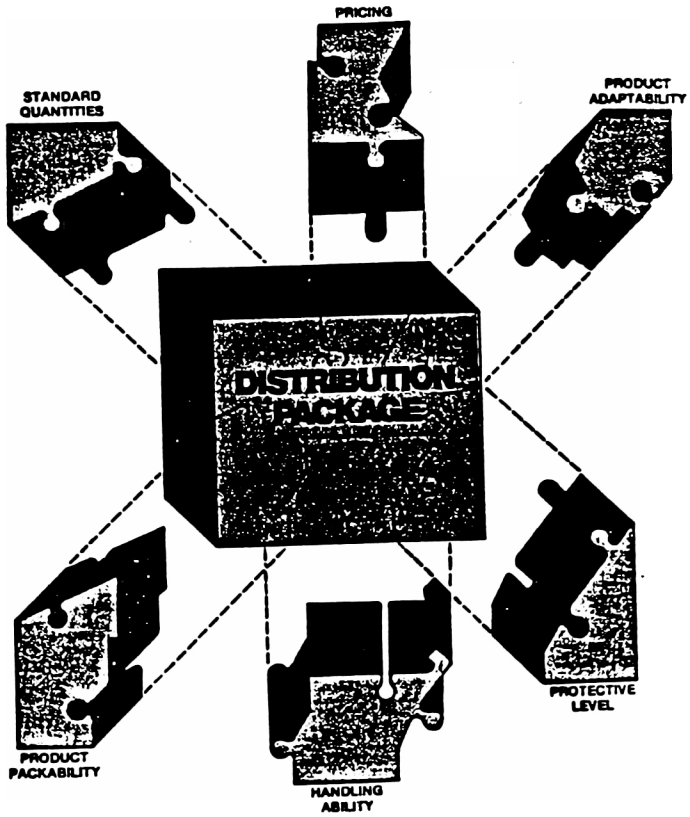


Figure 4-1 **Total package**[8]

The package is, therefore, a system with its own trade-offs. At one time, it may have been a given factor in logistics decisions. Today, package decisions involve management from the factory to the point of final sale.

Logistics elements in the packaging decisions

The traditional view of packaging focuses on four logistics elements: protection, handling, storage, and identification. Protection is fundamental and is also related to handling and storage. Handling involves individual units, cases, and the relationship to larger unit loads. Storage suggests long-term protection, but it also involves space utilization and stacking ability. Identification has become an important problem with the advent of optical scanning within the DC.

An increasingly important factor is the disposal of recycling of packaging materials. The high cost of packaging material makes it desirable to recover as much revenue from recycling or reuse as possible. This, too, is incorporated in package design.

Protection in packaging

Protection as the primary purpose of logistics packaging involves trade-offs among package dimensions, cost, and package weight. The package should prevent both damage to the product and external damage in the movement of hazardous materials. Specifically, protective packaging must guard against environmental damage, injury from physical movement, contamination, and pilferage. Environmental hazards include moisture, temperature, and product interaction with the environment. Physical hazards from movement include vibration, impacts, punctures, compression, and stresses on the package itself.

Proposed package designs must take into account both system handling requirements and the need for protection. Packages should be tested for vibration, shock resistance,

and static load resistance. They are then submitted to the carrier for evaluation and further testing. Experimental shipments may be made to establish direct practical experience. Once a testing program is completed, the shipper may request acceptance from the carrier, under a rate specifically designated for that package. Alternately, the shipper may forgo the entire testing process by shipping under rates that are free from any carrier liability (known as released value rates) and assume all risks of damage.

Handling and packaging dimensions

The requirement that packaging be compatible with each material handling unit in the logistics system creates enormous potential for conflict. The result is a tremendous variety of sizes. For example, it was found, that in one food DC there were 2,587 different sizes of distribution cases. There is a trade-off between uniformity, which reduces overall system packaging and handling costs, and optimal efficiency at each stage.

Order quantity

Packaging and order quantity influence each other, one through material handling efficiency, the other through trade practice. The latter may be influenced through changes in pricing. Instead of building packaging around traditional quantities, discount price structures can be used to create incentives to buy in quantities compatible with the system.

Packaging and information

Each package provides information. In a modern DC, where packages are passed on conveyor systems from the order-selection area to order assembly, packages

must be identified as they pass monitoring gates, either by manual operators or by optical scanners. Bar codes, which have become common in consumer packaging, are now being used in the DC. This requires the use of packaging materials which can be imprinted for high visibility.

Beyond the purchase cost, packaging affects the cost of every logistical activity. Package size affects transportation cost; unitization methods affect order picking and handling costs; identification technique affects inventory control; and customer service depends on damage control and the cost of unpacking and discarding packaging. Firms that manage packaging from an integrated logistical rather than traditional purchasing perspective find many opportunities for improving profitability.

Produce Packaging and Distribution Systems in the U.S.

Distribution

Distribution and marketing of fresh fruits and vegetables comprise multiple stage processes, including storage, handling and transportation, by land, sea or air, to markets which are sometimes thousands of kilometers away from the field or orchard where the produce was grown. Processing agricultural products generally follows either of two main routes: 1) processing and packaging for fresh consumption without substantial changes to the natural products, mainly fresh fruits and vegetables; or 2) converted agricultural products such as bread, canned produce, dried, dehydrated and frozen fruits and vegetables, juices, and jams.

The effort invested in preparation of fresh produce for marketing is generally proportional to the standard of living of the population where the produce is marketed and the distance between the product's source and destination. In a "primitive" society with low per capita income, produce generally is locally grown and consumed in season. Superficial manual sorting and cleaning before selling in a street market is all that is required. In urban industrial societies with high per capita income fresh produce is increasingly sold prepackaged in high volume supermarkets. There, the consumer can afford the benefits of premium quality attractively prepackaged produce, available in and out of season by import from different countries and by sophisticated storage facilities. Here, fresh produce processing includes cleaning, disinfecting, sorting, sizing, wholesale and retail packaging, controlled atmosphere cold storage, etc. These are high technology processes performed in mechanized high volume packaginghouses.

Modern produce packaging houses usually specialize in certain types of produce, such as citrus or deciduous fruits (apples and pears), avocados, potatoes, and carrots. The packing houses are usually located near the growing area of the particular product in order to minimize transportation distances of freshly harvested produce, as this is the stage at which it is most susceptible to damage and spoilage. These packaging houses are usually an integral part of a large-scale marketing organization, which may be a cooperative of all the farmers growing a particular product in a country or state. Sometimes the farmer is even compelled by law to market (primarily export) his product through the marketing organization. This prevents internal competition and enhances salability on foreign markets. Examples of such organizations in the United States are Sunkist Growers, which markets most of California's citrus fruits, and the Washington Apple Committee, which is an umbrella organization of Washington State apple growers. Similar organizations in other countries may be exemplified by the Israeli Citrus Marketing Board, Deciduous Fruit Board of South Africa, and Banana Board of Jamaica.

The proper handling of fresh produce from grower to store is a vital factor in maintaining the quality of the merchandise offered to the consumer. The food distribution center plays an important role in maintaining quality by 1) moving perishable produce quickly, 2) so handling it as to avoid bruising, and 3) providing proper levels of temperature and humidity.

Since produce costs more to warehouse and deliver, as a percentage of sales, than any other major commodity group, food companies find it worthwhile to give

considerable attention to devising handling systems that best serve their particular operation.

Receiving and inspection

According to produce specialists of several leading food companies, most produce- perhaps 75 to 80 percent is generally received by truck. Incoming merchandise is palletized by drivers. The receiving clerk pulls the product into the receiving area and dates it. Then a fork-lift truck operator moves the merchandise into the coolers. Pallets used for produce are generally a standard 48 by 40 inches.

Incoming produce is inspected as it is received. Responsibility for inspection, however, differs among various companies. In some companies, the produce warehouse superintendent is responsible for that function. In others, merchandisers or buyers inspect incoming merchandise. Although there is little uniformity in the assignment of responsibility for inspection, all companies stress the importance of making inspections of a continual basis. Variations in quality in the natural product are inevitable, and continual alertness is required to insure adherence to a company's quality standards.

Long distance distribution and modern marketing or fresh produce, comprising highly perishable commodities, totally depends on successful storage and preservation techniques. Storage is viewed here in a broad sense. It may be interim storage, before packaging (with or without precooling), long-term cold storage, storage in transportation vehicles, or retailing storage on supermarket shelves.

No matter where or how the produce is stored, the main objective is invariably to extend the useful life of the product, as determined by its suitability for fresh

consumption. Without modern refrigeration and produce preservation techniques most fruits and vegetables would have to be consumed within a few days, or sometimes even hours, after harvest. This is unthinkable in today's society of large industrialized urban centers, far removed from agricultural produce growing areas. Air freight and refrigeration chain transport enable sale of fresh cut flowers or vine-fresh strawberries harvested in the South and marketed the next day in Northern cities.

Application and use of modern fruit and vegetable storage and preservation techniques must be based on the knowledge and understanding of their nature and the internal physiology, as affected by the environment or storage atmosphere and time ("shelf life") are of primary concern of produce distribution.

The methods used to store produce at the distribution center vary considerably from region to region and from company to company. Five basic methods are in use:

1. The produce storage space is divided into three areas - "wet box" for items such as cabbage, carrots, celery, and corn, held at 32°F to 34°F and at 90% to 95 % relative humidity ; "dry box" for the items such as apples, grapefruit, grapes, lemons, lettuce, oranges, and peaches, held at 32°F to 34°F and at 85% to 90% relative humidity; and air-conditioned area held at 50°F to 55°F for items such as cantaloupes, tomatoes, onions, white potatoes, and sweet potatoes.

2. The produce storage space is divided into two areas - a 34°F room and a 55°F room. The 34°F room is used to hold both wet and dry perishables at 90% relative humidity. The 55°F room is used to hold those dry perishables requiring a higher temperature.

3. A single large area unbroken by partitions is zoned for temperature control. Cooling units are placed at various locations in the area at one end and at 35°F to 40°F at the other, with intermediate temperatures between. A metal baffle comes down from the ceiling to about 22 feet from the floor to help separate the area into two cooling zones.

4. A single large area is maintained at a temperature ranging from 34°F to 39°F for all the merchandise.

5. If a produce distribution center is located near the area where the produce is grown so that a high percentage of items is obtained locally, or if a very fast method of moving merchandise in and out of the warehouse is employed, produce storage space may be unrefrigerated. If, in addition, stores are relatively near the distribution center and receive deliveries frequently, refrigeration at the warehouse may not be considered necessary.

Shipping

Many companies deliver produce to stores five or six times a week, with distant stores or smaller stores receiving deliveries two or three times a week. Other companies deliver produce to all stores only three times a week.

Although the general practice is to use separate trucks for the delivery of produce to stores, many companies combine produce with dairy products when there is enough volume to justify use of a refrigerated truck at one set temperature.

The categories of merchandise making up mixed loads that include produce vary depending on whether the produce is to be refrigerated in transit. Thus, unrefrigerated produce may be combined with dry groceries. Refrigerated produce is more generally

combined with dairy products and delicatessen or meats. If produce is combined with frozen foods, provision is made for zoned temperature compartments.

Distances from warehouse to stores as well as frequency of deliveries also affect a company's decision on refrigeration of its warehouse and its trucks. Short runs and high turnover do not require as much emphasis on refrigeration as do longer runs and lower turnover. In the latter case, space requirements in the warehouse and transit are greater and call for preserving the product for longer periods.

In the transportation of produce from warehouse to stores, the major consideration is to safeguard the products. Rough and careless handling probably contributes more than any other single factor to the deterioration of fruits and vegetables. Careful stowing of the products to be transported is of the utmost importance.

Prepackaging

The function of prepackaging produce is performed to some degree by many food distribution centers, but relatively few companies maintain large central produce prepackaging operations. Many other companies consider prepackaging to be either a store function or a grower function.

For many products, most food companies prefer produce to be prepackaged at the grower level, because a) it can usually be done at lower labor cost, and b) it reduces the weight and bulk of the products to be shipped.

Certain grades of potatoes, apples, oranges, grapefruits, lettuce, cauliflower, broccoli, celery, and carrots are being prepackaged at the grower level at a lower total cost than they can be prepackaged elsewhere.

Other items, for which high spoilage is a factor, such as grapes, peaches, plums, and other soft fruits, are being prepackaged successfully at store level, where quality can be carefully controlled.

Still other items, such as tomatoes, chopped salads, spinach, and bananas, are being prepackaged at company-owned distribution centers to take advantage of the possibility of quality control, mass production, and uniformity of package.

The major benefit of prepackaging produce at company-owned distribution center is that it insures control of quality.

Handling and transportation

There are four principal modes of fresh produce transportation: overland, by 1) trucks or 2) railcars; 3) maritime, regular or container ships; and 4) airfreight cargo airplanes.

The transportation chain of produce from its source, e.g., the packing house, to its destination at the wholesaler's or retailer's storage warehouse may use only one of theses transpiration modes, or in rare cases it may even be a multistage process comprising a combination of all four.

When the transportation distances are relatively short, say less than 300 km, trucks provide the most flexible and reliable transpiration mode. In many countries, a sizable amount of fresh produce is in fact sold within a radius of 300 km from the place

of growth. On the other hand, transcontinental shipment of fresh produce such as West to East Coast shipments in the United States or export shipments to European countries may utilize several combinations of transport modes.

The longer the transportation chain, and the more transportation modes with interim storage and handling in between, the greater the hazard of damage losses and cost per ton shipment.

The main feature that sets fresh produce transshipment apart from other commodities and manufactured products is its perishability, requiring intransit ventilated cooling and heating facilities. This has prompted development of specialized fresh produce carriers of all the four major transportation modes, providing controlled environment in all weather conditions.

Thus, the modern produce transport chain also comprises a continuous refrigeration, or ventilated cooling chain, whereby optimal storage conditions are preserved from source to destination at all times.

The advent of unitized and containerized transport permits a significant reduction of the number and modes of loading and unloading stages with intermittent storage in between. Nevertheless, at least three such stages are almost always present: 1) field to packinghouse: 2) packinghouse to wholesalers or retailers; and 3) retailers to consumers.

Modern transport modes must be suitable for moving fresh produce (and nonperishable foods) from the agricultural production areas to the industrial centers, while hauling back manufactured products. Significant inefficiencies occur when

transports are full only one way. One of the reasons the U.S. economy is so successful is due to the relative predominance of West to East Coast movement of agricultural commodities, while industrially manufactured products move the other way.

The need for multipurpose transport and the requirements of specific environments for each produce commodity, under various weather conditions en route, should serve as guidelines for future research and development in fresh produce transport modes.

Trends in produce distribution

The organization and management of distribution systems (i.e., warehousing, shipping, order filling, etc.) is highly susceptible to automation and computerization; this process is already underway and the trend will continue. Economy, efficiency, and quality of service are all strong driving forces in this development.

The cost of transportation, per se, will be an increasingly important factor in the processed food industry because there are no technological developments forecasted that will contribute to increased efficiencies in this field. This situation, combined with a continuous shift toward consolidation and centralization of food processing plants in order to gain the advantages of economies of scale, will encourage a shift toward concentrated, shelf-stable food ingredients.

Finished food products in the more affluent, developed countries of the world are not as susceptible to these forces because "quality," "freshness," and "naturalness" are such dominant factors in determining choice at the point of purchase. However, in underdeveloped countries where transportation systems are more poorly developed,

there is tremendous opportunity for dehydrated, concentrated, and/shelf-stable food products. The challenge in this case is to get the cost of the products down to a level that is affordable by the potential consumers.

The developments emphasize the key significance of the current trend to minimize the cost of shipping water around in the form of foods from one location to another. In short, in some circumstances it is less expensive to remove the water at the point of production or initial processing and then add water to the concentrate or to the dried product at the point of distribution and consumption.

Conclusion

The basic objective of this study was to to give an overview of the main concepts of logistics, packaging handling, and distribution and the role which they play in the contemporary American society. Three primary areas- logistics, packaging distribution and produce packaging and distribution were examined. Because of the exploratory nature of the study, the results produced a descriptive model for the above topics.

The study can provide Russian packaging personnel with some basic ideas how to structure logistics management which plays an important role in business process in the USA. Volume of production can not in any way overcome poor production and distribution, but that is exactly what is happening in Russia right now. 70 years of central planning, emphasizing the production of foods without concern for preservation and distribution, failed to deliver food to people. Volume production can not overcome poor protection and distribution systems.

Packaging has a significant impact on cost and productivity of logistical systems in the USA. That is why the the study also provided logistical packaging concepts as functional framework and as well as packaging opportunity for Russian packaging industry.

Packaging must play a most important role in improving food distribution with the objective of reducing waste and thus increasing food availability. The food spoilage in the US is the lowest in the world, about one tenth the level in Russia and most developing nations. The amount of food that proper packaging would save from

spoilage alone could increase significantly the ultimate yield of many existing harvests in Russia and other republics of CIS.

Another benefit due to improved food packaging will be a food costs as a part of disposable income. In this country, food costs are under 15% of disposable income, compared to much higher rates in the developing nations such as Russia. The challenge for food packaging in Russia is great, but the potential benefits are worth the effort.

Emphasis should be on total distribution operation needed in Russia. The country must provide adequate warehousing, ports, information processing facilities, materials handling equipment, skilled labor, and logistics management. The country needs to analyze and integrate its transportation system with the total distribution facilities to provide a balanced logistics efforts.

The level of logistics sophstication in the US may be greater than anywhere else in the world. And one of the greatest needs in developing countries (especially in Russia) is for logistics knowledge. The US logistics professionals must find ways to share the wealth of information, experience and technology. Hopefully the study will help to contribute the development of the packaging logistics and distribution in Russia.

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