INFORM

Delivering the Goods

Benefits of Reusable Shipping Containers

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Printed in the United States of America

ISSN #1050-8953 Volume 3, Number 1

Printed on 50% recycled paper, with 15% post-consumer waste content

INFORM Special Reports cover the full range of environmental issues INFORM studies. This special report examines the opportunities and obstacles involved in implementing one specific strategy for preventing the generation of packaging waste: reusing shipping containers. Prepared by David Saphire, research associate in INFORM's Sustainable Products and Practices Program, and edited by Sharene Azimi, it is being issued as part of INFORM's ongoing research and public education on the problems of solid waste generation and opportunities for businesses to reduce at the source the amounts of waste they generate.

INFORM, Inc., is a nonprofit environmental research organization that examines business and municipal practices that threaten our environment and public health; assesses changes business and government are making to improve their performance; and identifies new business strategies and technologies moving the United States toward an environmentally sustainable economy. INFORM's research currently focuses on strategies to reduce industrial and municipal wastes and to preserve air and water quality.

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Acknowledgments

This report has benefited from the insights and observations of a number of people. I would like to thank the individuals at Xerox Corp., Toyota USA, Wakefern Food Corp., Dom's Empty Package Supply, Pepsi-Cola, Perstorp Xytec, and Schoeller International who personally met with me, as well as all the other people mentioned in this report who supplied INFORM with information about their companies' operations.

A special note of thanks to John Okun of Long Island City Business Development Corp., Peter Larkin of the Food Marketing Institute, Tom Kacandes of the New York State Department of Economic Development, and Michael Reilly of Wakefern for reviewing the pre-publication manuscript and providing thoughtful comments.

At INFORM I wish to thank Joanna D. Underwood, president, for her support, and Dr. Warren R. Muir, senior fellow, for reviewing the manuscript. Thanks also to researchers John Winter, Bette Fishbein, Jeff Hargrave, and Carolyn Nunley for their insightful discussions on solid waste issues. Special thanks to Sharene Azimi for her precise editing and to Mimi Bluestone, director of publications, for her editorial guidance. Thanks to Elisa Last, production coordinator, for creating the graphics. Thanks also to former INFORM researcher Caroline Gelb for researching parts of this report.

INFORM thanks the many individuals and organizations without whose support our work would not be possible. In particular, INFORM thanks the Risk Reduction Engineering Laboratory of the Office of Research and Development of the US Environmental Protection Agency. Although the gathering of information in this document has been funded by the US EPA, this report does not necessarily reflect the views of the Agency, and no official endorsement should be inferred.

While this report benefited from the help of these and many other individuals, the contents and analysis are the sole responsibility of INFORM.

I. Introduction: Why a Report on Reusable Shipping Containers

Anyone who has ever moved from one home to another has probably picked up some empty boxes from the supermarket or liquor store for packing. Why does there always seem to be a surplus of these boxes? Because most corrugated containers are used commercially only once.

These boxes form a significant portion of the US municipal solid waste stream. Of the total 196 million tons of municipal solid waste generated in 1990, packaging represents nearly one-third, and packaging materials used to transport goods make up nearly half of packaging waste.

In 1990, US producers of corrugated boxes made 25 billion of them - almost 100 boxes for every person. Corrugated boxes accounted for 12.2 percent of the national municipal solid waste stream in 1990, contributing 24 million tons of waste, or about 188 pounds for every US resident.

A dilemma that haunts the United States today is this: what should be done with all of this solid waste? Incineration is increasingly unpopular because of concern over its environmental and public health effects. Recycling is an important way of recognizing and recovering the value of the natural resources contained within discarded products. But recycling does not address several crucial questions: Do we need all these boxes in the first place? How much material does a packaging system need to accomplish its purposes? How is it possible to reduce the overall generation of waste?

Each portion of the waste stream requires its own waste reduction solutions. Because packaging comprises such a large segment of the total, any strategy that aims to reduce packaging can have a significant impact on the nation's solid waste burden -a burden that includes not only the cost and difficulties of managing wastes, but one that reflects, as well, wasted materials and resources.

This report examines the opportunities and obstacles involved in implementing one specific strategy for preventing the generation of packaging waste: reusing shipping containers. Reusing containers can lead to dramatic reductions in the generation of solid waste. As shown in one hypothetical example, a company that makes shipments in single-use corrugated boxes can cut the quantity of container material needed for 1 million shipments by 50 percent if it uses those boxes twice; by 70.6 percent if it ships its products in reusable corrugated boxes that can be used five times; and by 98.5 percent if it switches from single-use corrugated boxes to plastic containers that can be used 250 times (see Table 1 on page 5). As the total weight of container material represents the amount of material that, ultimately, must be recycled or disposed of, these reductions can be quite significant.

Through a series of case studies, this report describes settings in which companies currently reuse shipping containers, obstacles to reuse, and options available to both industry and government for expanding the use of reusable containers.

By reviewing trade journals that cover the distribution and packaging materials industries,' INFORM identified a number of companies that manufacture reusable shipping containers, both in the United States and abroad, and ultimately identified many US users of reusable shipping containers, including the 10 companies described in this study. Manufacturers, especially in the automobile and the electrical and electronics industries, have reused shipping containers since the mid-1980s. Food producers traditionally have shipped some items, such as bread and milk, in reusable crates. Major soft drink bottlers in recent years have switched to reusable crates for shipping some bottles directly to stores. And certain other retail sectors are increasing their use of reusable containers, especially for shipping goods from distribution centers to individual retail outlets.

Based on interviews and site visits, INFORM has prepared case studies of two major manufacturers, Xerox Corporation and Toyota USA, and of various companies in the grocery and supermarket industry that reuse shipping containers. These case studies provide examples of how reusable shipping container systems work. The case studies do not constitute a comprehensive survey of US companies involved in reusing shipping containers, but the systems profiled provide models for reuse that could be replicated by other companies.

Findings

As shown in this report's case studies, reusing a container means that less material is needed to manufacture containers and, ultimately, that less material requires recycling and disposal. Similarly, reuse of packaging can save money for companies that either ship or receive products.

Environmental benefits The primary environmental benefits of reuse are:

Source reduction: Preventing waste

In recent years, national leaders from environmental organizations, the United States Environmental Protection Agency (EPA), and business have all come to agree that source reduction should be viewed as the nation's top waste policy option, followed by recycling, waste-to-energy incineration, and landfilling. INFORM defines source reduction as a reduction in the amount and/or toxicity of materials entering the waste stream prior to recycling, treatment, or disposal. Source reduction applies to municipal solid waste and to waste resulting from other stages of a product's life cycle, including raw materials extraction, processing, and distribution.

Source reduction differs from recycling, which diverts materials that have entered the waste stream and uses them in place of virgin feedstocks to make other products. Source reduction instead prevents materials from becoming part of the waste stream at all. Materials that are discarded, whether recycled or not, require costly and time-consuming collection, handling, and processing in a materials or waste management system. Source reduction reduces or eliminates the need for this effort.

Besides preventing waste, source reduction conserves resources. Reusing transport packaging reduces raw materials use, avoids the need for energy to manufacture or recycle containers, and reduces pollution arising from the manufacture or recycling of containers. However, a reusable shipping container system may require different transportation logistics than a one-way (single-use) system and thus may entail different levels of transportation energy use and related pollution. Moreover, a company's decision to use, for example, plastic instead of corrugated cardboard containers, whether reusable or one-way, will have different implications for the environment, affecting the use of natural resources, the kinds and quantities of pollutants that enter our air and water, and the use of energy in making, transporting, and recycling those packages.

This INFORM report has not attempted a life-cycle analysis to determine the relative environmental benefits of reusable versus one-way containers. Nor has it attempted a cross-materials comparison of the life-cycle impact of using reusable plastic versus one-way or reusable corrugated cardboard. However, it does identify opportunities for reducing solid waste and cutting overall distribution costs through the reuse of shipping containers.

- Waste prevention
- Resource conservation, including energy and raw materials

Economic benefits Reuse provides savings by reducing the cost of:

- Packaging
- Disposal
- Product damage due to shipping and handling

In addition, some companies report that they have found additional long-term cost savings associated with implementing a reusable container system, including reduced costs of:

- Freight
- Labor and handling
- Storage[2]

Four features of reusable systems INFORM has identified four features (discussed in Section II) that are generally conducive to the reuse of shipping containers:

- Short distribution distances
- Frequent deliveries
- Small number of parties
- Company-owned or "dedicated" distribution vehicles

Five obstacles The report also identities five obstacles to expanding the reuse of shipping containers:

- Large initial capital expense
- Cost of tracking and accounting for containers
- Cost of returning containers to points of origin
- Lack of storage space for empty containers
- Resistance to change on the part of suppliers, distributors, and customers[3]

Seven options that promote reuse The ease or difficulty a company may encounter in reusing shipping containers will depend on the total distribution system through which containers must pass and the total cost of distribution, including the cost of packaging materials, transportation, handling and labor, storage, and disposal, recycling, or reuse. The report concludes (in Section V) with an outline of government and industry options for overcoming the above obstacles and facilitating reuse. These options include:

- Third-party leasing of containers
- Industry-wide standardization
- Cooperative efforts between producers, suppliers, customers, and distributors
- Designing containers to be easily stacked and stored
- Adopting more frequent and direct delivery systems
- Government-backed model programs, low-interest loans, or tax credits
- Government procurement guidelines that favor reuse

Figure 1A: Categories of Products and Packaging in the 1990 US Municipal Solid Waste Stream

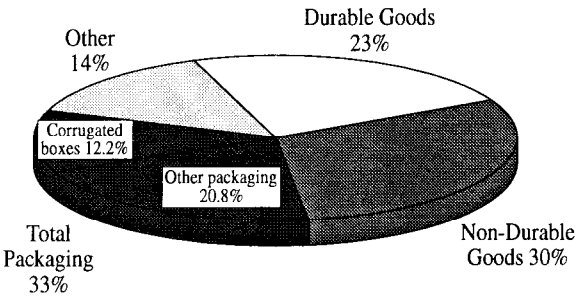
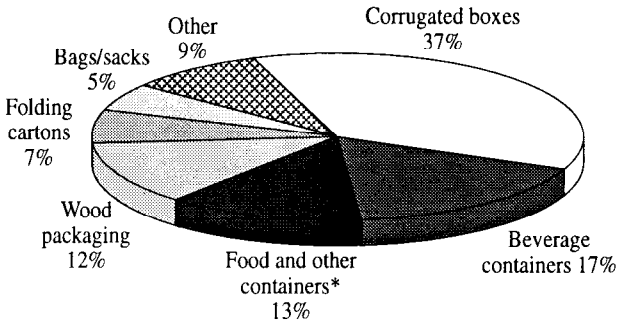


Figure 1B: Leading Categories of Packaging in the 1990 US Municipal Solid Waste Stream



* Food and other containers includes bottles, jars, cans, and other containers made from glass, steel, aluminum, and plastic.

Source for both pie charts: Franklin Associates, 1992

The three major packaging categories

Opportunities for reducing the amount of material used in packaging systems vary, depending on the type of packaging involved. Packaging falls into three categories, which may overlap:

Primary or consumer packaging is the basic package that contains a product (e.g., soup can, soda bottle, soap powder box) and is used by the consumer until the product is consumed. Primary packaging is designed to contain and protect the product and to appeal to consumers and stimulate product sales.

Secondary packaging is additional packaging designed to facilitate self-service sales, to prevent theft, to further advertise and market the product, or to facilitate use by the consumer (e.g., toothpaste box, six-pack carrier). Secondary packaging is generally discarded when the product is opened.

Transport or distribution packaging is packaging used to ship goods from their point of origin, such as a production facility or farm, to their destination, (e.g., to a manufacturer, wholesaler, retailer, or consumer). For distribution packaging, which includes boxes, crates, pallets, banding, and void fill packaging (e.g., polystyrene "peanuts"), the greatest emphasis is placed on protective, functional (handling, opening, closing), and shipping considerations. The box or crate that physically contains the product is often referred to as the shipping container. Such a container may be designed for single or multiple use.

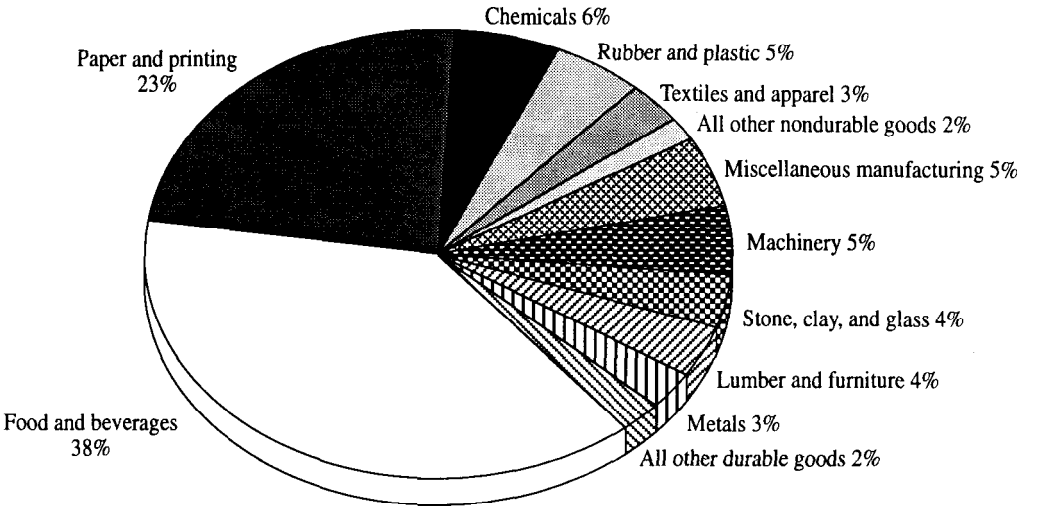
In the United States today, most shipping containers are shipped in bulk units, called unitized loads, in which a number of small containers are stacked onto a pallet or slipsheet, secured with shrinkwrap or banding, and loaded and unloaded onto transport vehicles by mechanical handling equipment such as forklift trucks or cranes. (Pallets are portable platforms, typically made of wood or plastic, used for storage or movement of materials and packages in warehouses, factories, and transport vehicles. Slipsheets are thin paper or plastic sheets with protruding tabs that replace pallets for stacking and moving containers.)

Corrugated shipping containers: A significant portion of the waste stream

As shown in Figures 1A and lB, corrugated cardboard containers make up the largest category of packaging waste. In 1990, an estimated 90 to 95 percent of all US manufactured consumer, wholesale, and industrial goods were shipped in corrugated boxes. Adding wood packaging (primarily wooden pallets and crates) brings the contribution of transport packaging to more than 16 percent of the total national municipal solid waste stream.

The contribution of corrugated boxes as a percentage of the national municipal solid waste stream, by weight, has increased steadily, from 8.3 percent in 1960 to 12.2 percent in 1990. Recycling of corrugated packaging has also risen. In 1990,48 percent of all corrugated packaging in the US waste stream was recovered for recycling. None-

*Figure 2: Shipments of Corrugated Boxes by End Use Industry, 1993**
Durable and Nondurable Goods



* Percentage of shipment by Standard Industrial Classification (SIC) of Corrugated Customers
Source: Fibre Box Association, 1993 Annual Report

theless, 12.5 million tons still required disposal in 1990, up from 4.8 million tons in 1960. The Environmental Industry Association (formerly the National Solid Waste Management Association) estimated in 1992 that the cost of recycling corrugated cardboard was $43 per ton, not including collection or transportation[4]

Recycling of wooden packaging (pallets and boxes) in the past has been negligible. However, it appears that the contribution of wooden packaging to US landfills will decline, with landfill restrictions in many parts of the country spurring greater reuse and recycling efforts such as pallet reconditioning and exchange.

Today's leading shipping container: The corrugated cardboard box

Corrugated cardboard, a paper product, is valued in distribution packaging for its light weight, strength, and low cost. Corrugated boxes are used primarily as transport packaging. In general, they do not come in direct contact with consumer products in the way that primary or secondary packages do. Corrugated boxes instead serve the purpose of holding together units of product, a function called "unitizing," for protection and easy distribution.

Figure 2 shows the major users, by industry sector, of corrugated boxes in the United States in 1993. The food and beverage industry (producers of fresh fruits and vegetables, meat, dairy products, canned and preserved goods, bakery products, and confectionery supplies) led in the use of corrugated containers. The food and beverage industry's role as a user of corrugated boxes in the United States rose between 1972 and 1990 from 28 percent of all corrugated containers to 38.8 percent.[5]

Source reduction options for shipping containers

There are at least four ways to reduce transport packaging at its source:[6]

- **Lightweighting** Reducing the amount of material used in a container made of a specific material without compromising the container's strength, for example, by thinning the wall of a corrugated container.
- **Selecting another material** Reducing the amount of material used to transport products by replacing packaging made of one material with packaging made of a smaller quantity of another material, for example, by delivering soup cans in corrugated trays covered with shrinkwrap instead of in corrugated boxes.

Table 1: Comparing number of boxes, weight of box, and total weight of box material used to make 1 million shipments of equal volume in one-way and reusable corrugated boxes and reusable plastic boxes

Box material and number of times used	Number of boxes used for 1 million shipments (thousands)	Weight of box (pounds)	Total weight of box material used per million shipments (tons)
One-way corrugated, one time	1,000	1.5	750
One-way corrugated, two times	500	1.5	375
Reusable corrugated, five times	200	2.2	220
Reusable plastic, 250 times	4	5.5	11

SOURCE: INFORM

- **Bulk packaging** Packing products in larger containers to reduce the amount of packaging per product being shipped, for example, by switching from individual bags of flour to silos.
- **Switching from single-use to reusable containers**

This report examines opportunities for employing reusable shipping containers as an alternative to single-use transport packaging.[7]

Reusable shipping containers

Whether reusable containers are made of corrugated cardboard or of other materials, such as plastic, reuse provides opportunities to reduce the amount of material used to ship goods and to reduce the amount of material entering the waste stream. For example, over the course of its lifetime, a 2-cubic foot plastic reusable shipping container weighing 5.5 pounds and making 250 trips will replace 250 1.5-pound single-use corrugated boxes weighing a total of 375 pounds[8]The single-use container will generate 98.5 percent more waste measured in weight than the reusable container (5.5 pounds versus 375 pounds).

This kind of reduction can be quite significant for a company that uses large numbers of boxes. As shown in Table 1, a hypothetical company that makes 1 million shipments in a year could cut the total weight of box material used per million shipments 50 percent if it uses those boxes twice and by 70.6 percent if it switched to heavier corrugated boxes that could be used five times instead of once. The same company could reduce the total weight of box material by 98.5 percent if it changed from single-use corrugated boxes to plastic containers that can be used 250 times[9] The total weight of box material is significant because it indicates the amount of material that, ultimately, must be recycled or disposed of.

II. Distribution Packaging Systems in the United States

Apart from reducing waste generation, reusing shipping containers can lower a company's packaging costs. As seen in Table 2, which compares the cost of three types of shipping containers, the initial cost of a single-use corrugated container is 95.2 percent less than the initial cost of a reusable plastic container. However, if the plastic container is used 250 times, the reusable container costs 91.7 percent less per use than the single-use corrugated container.

However, the cost of packaging is not the only consideration in choosing between single-use and reusable transport packaging. A number of activities make up the distribution system for various products, and besides containing and protecting products, shipping containers must be designed to be compatible with the entire system through which they will pass. According to Charles W. Ebling, president of Logistics Support Systems in Westville, Connecticut, purchasing managers consider the total value of goods or materials in deciding what to spend on packaging. They research the potential sources for raw materials and supplies and evaluate total procurement costs, which include packaging, storage, handling, and shipping. [lo]

Ebling cautions that choosing the least costly packaging material or container does not necessarily result in the

Table 2: Lifetime Cost Comparison of One- Way and Reusable 2-cubic Foot Shipping Containers, by Material

	Corrugated One-way	Corrugated Reusable	Plastic Reusable
Weight (pounds)		2.2	5.5
Initial cost	1.5	$1.06	$11.03
Estimated life (number of trips)		5	250
Cost per trip (average)	$0.53	$0.21	$0.044

Source: "How to Select Shipping Containers," Buckhorn, Inc., Milford, Ohio, 1991

lowest overall physical distribution costs. Whether single-use or reusable packaging is used, a number of other factors affect cost, including the type of packaging used, the type of material, handling and labor, shipping (freight), storage, and disposal or reuse costs.

Costs in a packaging system

Material costs

The cost of materials used in a packaging system varies widely and depends on the product's protective and marketing requirements. With some products, for which no merchandising considerations enter into the selection of the package (such as parts for automobile manufacturing), the packaging cost is usually based on the level of protection desired for the product. The cost of transport packaging for expensive electronic components, for example, may represent a small fraction of the product cost. The packaging cost for shipments of cement, on the other hand, may be much greater relative to the product cost. The level of protection for cement may be set to anticipate a certain percentage of product loss in 'shipment because the cost of replacing this loss may be less than the cost of improving packaging to provide full protection."

Handling and labor costs

The process of shipping goods may involve the participation of many parties at different points. Therefore, shipping containers must be compatible with a variety of handling methods and equipment. For example, in shipping automobile parts from supplier to manufacturer, individual containers holding parts should be compatible with the handling methods and equipment involved in the following procedures:

- Packing containers
- Placing individual containers into bulk units on pallets or slipsheets
- Moving unitized loads to shipping docks
- Loading and unloading trucks
- Transporting unit loads from shipping docks to storage or assembly areas
- Fitting individual containers onto assembly line equipment

A change in handling to accommodate new container types may add to the cost of shipping, storage, and disposal or return of containers.

Shipping (freight) costs

Cost-efficient transportation requires optimum utilization of available space (known as "cube efficiency") inside transport vehicles, without exceeding highway weight limits. The shape and size of containers and pallets, as well as how they are loaded into position in transport vehicles (trucks, rail cars, cargo ship containers), will determine how much of the available space is used. To be cost-efficient, individual containers and unitized loads should conform to the interior dimensions of the transport vehicle.

For example, if the width of a trailer is 90 inches, then the width of a pallet used in that vehicle should be 45 inches, not 50 inches. This will allow for two pallet loads to be placed across the width of the truck. By the same measure, individual containers should conform to the dimensions of the pallet to maximize the number of containers that can be placed on that pallet. If containers are stackable, pallet loads can be built higher, taking advantage of interior space. This will allow for the shipment of more product per delivery.

Storage costs

As is the case with shipping, cost-efficient storage depends on the dimensions and stackability of bulk units to maximize available warehouse or storage space.

Disposal or return costs

Even after materials or goods have been delivered and unloaded, single-use and reusable packaging entail different costs. Single-use container systems entail handling and labor costs related to recycling or disposal, including: special handling equipment (compactors and bailers); material pickup and disposal; and labor to sort and place items in appropriate waste containers, compactors, or bailers.

Reusable containers entail a different set of costs associated with the return of containers to their point of origin, including: administrative costs for managing and controlling the flow of full and empty containers; the cost of labor needed to put empty containers back on pallets for return shipments ("restaging"); the freight cost of hauling back empty containers; and the cost of cleaning and repairing containers.

Other considerations in reusing shipping containers

Once a company opts for reusable containers, there are a number of design features that can lead to further cost savings and logistical benefits. For example, standardization of container sizes may help increase transportation efficiency. However, one-way containers could be standardized as well.

Shipping containers are generally designed to fit into an existing distribution system. However, in some cases the potential to save by changing packaging may be great enough to justify changing the distribution system through which it passes. In other cases, reusable container systems are planned in the context of larger changes in shipping and receiving. The Xerox Corporation case study in this report describes this type of change.

The time period over which a reusable shipping container is functional - its "useful life" - affects its total material cost. Reusable containers may cost 2-to-20 times as much as one-way containers, so the number of times the container is reused (its trippage) is a crucial variable in calculating total material cost. In addition to anticipating the number of trips a container will make, it is important to establish the number of containers (the float) that will be needed at the outset and at any given time.

Investing in a float of reusable containers requires a much larger initial investment than would be needed to buy one-way containers. Not only must capital be available, but a system must be in place to guarantee the return of empty containers.

Features of systems compatible with reusable shipping containers

Reusable shipping containers generally work best when the following features are present. These features may overlap:

- **Short distribution distances** Shorter distances mean lower back-hauling costs. Shorter distances also expedite the return of containers to suppliers.
- **Frequent deliveries** Frequent deliveries usually mean that inventory turns over rapidly, which means that empty boxes are available for collection at the time of delivery. This makes it possible to collect empty containers with each delivery, minimizing the number of containers in storage and transport and minimizing the size of the float of containers that a company must purchase and maintain.
- **Small number of parties** Controlling the return of empty containers is easier when the number of parties handling containers is small, for example, when a bakery delivers directly to a grocery store without intermediate storage in a warehouse.
- **Company-owned vehicles** If companies involved in shipping and receiving use company-owned vehicles there is typically no charge for return shipping, especially if trucks would otherwise return empty to their point of origin after making a delivery. Producers may also work with trucking companies that have dedicated all or part of their fleet to making deliveries to or from a single customer.

The features just described generally are found in closed-loop distribution systems, including inter-plant shipping of materials from one part of a company to another. In general, closed-loop systems are systems in which the container always goes back to the same point of origin, passing through the same gateways. Most of the time, it is possible to account for the container's location within the loop. However, as described later in this report, large, multi-plant operations such as Xerox, which ship or receive supplies over long distances, may find it more effective to use an "open-loop" system in which containers need not return to their point of origin. In addition,

reusable shipping containers may also work well in open-loop systems in which containers are managed by third-party logistical service contractors.

Physical properties of reusable shipping containers

Reusable shipping containers may be made from a number of different materials, including corrugated cardboard, fiberboard, plastic (such as high density polyethylene [HDPE] or polypropylene), wood, and steel. The choice of material influences the number of times the container may be used and ultimately its cost per use (as shown in Table 2), as well as the amount of material that ultimately is discarded.

Reusable containers of all materials may be designed with a number of features that facilitate shipping, handling, and storage, including:

- **Collapsibility** The walls of the container are designed to fold down when collapsed.
- **Nestability** Empty containers can easily be placed into one another.
- **Stackability** Tops and bottoms are designed to lock into one another to allow for greater stacking heights.

The first two features allow for a reduction in the space empty containers take up in transportation and storage and allow for more containers to be hauled back than were delivered full. (Collapsed containers may use 3-to-6 times less space than assembled containers.) Stackability makes it possible to make maximum use of the full height of space in warehouses or delivery vehicles.[12]

Collapsibility, nestability, and stackability may not be suitable under all circumstances. For example, many of Toyota USA's suppliers ship parts to Toyota in reusable shipping containers that hold reusable dunnage (cushioning or padding used to protect fragile parts against shock or breakage). The dunnage is returned to suppliers inside the empty containers, precluding the use of collapsible containers. Toyota also ruled out nestable containers. Nestable containers have "drafted" (slanted) walls that allow them to fit together and pull apart easily, but they may hold less than straight-walled containers, which cannot be nested. Thus there is a trade-off between the amount of product being shipped per delivery versus the number of empty containers that can be back-hauled at. one time.[13]

Other features that affect shipping, handling, and storage include:

- **Lids** Lids may be separate from or attached to the body of the container. Separate lids facilitate access to the container interior, while attached lids may save time in handling.
- **Side Access** Some containers feature side doors that drop down for unloading parts from stacked containers. This allows workers to randomly select parts for quality control without disturbing the stack.
- **Solid vs. lattice-work walls and bottoms** Solid walls are best to hold bulk shipments (such as liquids, powder, grain, or chemicals) and to keep out contaminants. Lattice-work or open walls or bottoms permit drainage or allow air to circulate through the container (for example, for produce or food packed on ice).
- **Size** The size of a shipping container depends in part on whether the container will be handled manually or mechanically. Containers may range in size from l-cubic foot totes designed to be handled manually (such as on assembly lines or in supermarkets) to 80-cubic foot bins used to ship bulk ingredients. Some bulk bins are designed with a pallet-like bottom to allow for forklift access, thereby eliminating the need for a pallet.

Reusable shipping containers in two retail operations

While single-use corrugated boxes are the leading transport package in the United States, a number of industries have opted for reusable shipping containers in their operations. Besides the manufacturing and supermarket industries described in the case-study section of this report, certain retail sectors are also increasing their reuse of containers for shipments from distribution centers to individual stores, especially for fast food, health and beauty aids, clothing, and pharmaceuticals. Bergen Brunswig Drug Company and In-N-Out Burger are companies in two of these fields that are using reusable containers to ship from central facilities to retail outlets.

Pharmaceuticals: Bergen Brunswig Drug Company

In 1987, the Bergen Brunswig Drug Company in Orange, California, purchased 120,000 returnable plastic containers to replace one-way corrugated cartons. The company ships from its 37 distribution centers to its 10,000 pharmacies, located in 40 states.

Brunswig reports that the elimination of carton assembly and manual taping operations has enabled the com-

pany to save money on packaging and labor. Other savings include conservation of warehouse space (corrugated cartons were once assembled on the warehouse floor); better truck space utilization with the new containers, which stack to completely fill the 8-foot height of the company's box van; reduced damage to merchandise; and a reduction in trash. The plastic containers also fit better into Brunswig's new automated distribution centers, where automated power conveyors would crush corrugated boxes.[14]

Fast Food: In-N-Out Burger

In-N-Out Burger in Baldwin Park, California, switched from one-way waxed corrugated boxes to reusable plastic totes for shipping meat patties and bags of dressing from its processing facilities to its 84 stores in and near southern California. The company reports that eliminating 200 tons of nonrecyclable waxed cardboard annually has led to an estimated $24,000 in savings on disposal and packaging. In-N-Out recovered the initial $140,000 cost of the totes during the first 11 months of use.[15]

A manufacturer of reusable shipping containers

A number of companies in the United States manufacture reusable shipping containers. One company, Perstorp Xytec (formerly Xytec) in Tacoma, Washington, introduced the first large, solid-wall plastic bins to the US market in 1973.[16] The bins were designed for the agricultural and fishing industries as an alternative to wooden and steel containers. In the mid-1980s Perstorp Xytec began designing specialized reusable container systems, such as the first collapsible plastic container in the United States, for major automobile manufacturers, including General Motors and Ford. Other customers in the auto industry include Chrysler, Honda, and Volkswagen as well as some of the suppliers to these automakers.

Other Perstorp Xytec customers include the fishing, agriculture, utilities, and transportation industries and consumer markets. One segment of its market involves maquiladoras ("twin plants") that use reusable containers to ship materials across the US-Mexican border. Johnson & Johnson is one such customer: it ships precut surgical garments from Texas to be sewn in Mexico, where labor is significantly cheaper.

According to Perstorp Xytec, reusable shipping containers are used most frequently by its customers for distribution between vendors (suppliers) and manufacturers and between sub-suppliers and suppliers. Perstorp Xytec offers its customers a free "cost justification" service for companies interested in switching to reusable containers. In this cost analysis Perstorp Xytec computes a customer's potential savings in the areas of transportation, container cost, product damage, storage, and disposal. Perstorp Xytec and other manufacturers of reusable shipping containers also rent or lease their containers for a trial period to allow companies to test the benefits of a reusable shipping container system.

III. Reusable Shipping Containers in Manufacturing Industries

In the United States, a number of manufacturers of automobiles, electronic goods, and appliances have worked with their suppliers to develop systems in which the suppliers ship parts in reusable containers. The automobile industry in particular and the manufacturing sector in general lend themselves to reusable packaging because parts are delivered frequently, often over short distribution distances. For example, many suppliers to the auto industry are located in and around Detroit-area auto assembly plants.

Just-in-time delivery systems complement reuse

The development of just-in-time delivery systems has helped spur the use of reusable shipping containers in manufacturing, especially in the automobile industry. Just-in-time (JIT) is a delivery strategy that manufacturers use to reduce the quantity of supplies kept in inventory. Instead of making infrequent deliveries of large volumes of parts that are inventoried over long periods of time, suppliers make smaller deliveries on an as-needed basis.

One JIT operational technique is to bypass traditional central receiving facilities by delivering inbound materials as needed directly to the point of use on the production line. This results in faster turnover of materials and a reduction in product inventory. Less inventory means that warehouse space previously used to store parts can now be used for production or other purposes. JIT systems appear to work best when vendors are located near manufacturing facilities; when the number of participants, including vendors and carriers, is limited; and when these

participants are committed to working together over a long period of time.

Reusable container systems are compatible with JIT programs because containers can be moved into production facilities and then, almost immediately, moved out again. This means suppliers can maintain smaller numbers of containers. Working with fewer dedicated companies facilitates control and administration of empty containers, especially if companies use proprietary containers. For example, a dedicated trucking company may serve just one customer or dedicate some portion of its trucking fleet to serving only that customer.

INFORM'S research shows that reusable shipping containers have saved manufacturers and suppliers money in the following areas:

- **Reduced packaging** costs As the cost of reusable shipping containers is amortized over their useful life, the cost per trip is lowered, making reusable containers cheaper than single-use packaging. This results in savings, either for manufacturers, if they have traditionally supplied vendors with containers, or for vendors, if they are responsible for purchasing containers. Vendors' elimination of one-way packaging and subsequent long-term savings may result in a lower per-piece price for parts shipped.
- **Reduced damage** Reusable containers are usually sturdier than one-way containers because they are designed to withstand multiple uses, and switching to reusable containers can result in lower rates of damage of incoming supplies.
- **Avoided disposal** costs Eliminating one-way containers also eliminates the need to landfill or recycle them.

In addition, production, distribution, and productivity improvement systems, such as just-in-time delivery, that complement reusable shipping container systems may lead to other savings such as:

- **Reduced labor** costs Freeing workers from the task of breaking down single-use corrugated containers and removing them from assembly-line operations can offer savings. Standardizing containers to conform with assembly-line layouts can eliminate the need for labor to repack incoming supplies into containers compatible with the assembly line.
- **Reduced storage** costs Reusable shipping containers may stack to higher heights than one-way corrugated containers, taking full advantage of available warehouse space. Just-in-time delivery in reusable shipping containers may allow companies to use warehouse space previously used for storing inventory for other purposes.
- **Reduced freight** costs The switch to standardized containers may allow for greater utilization of space inside trucks, resulting in more shipments per delivery and thereby reducing freight costs. These savings are often greater than the cost of back-hauling empty containers.

The benefits of standardized containers on the assembly line are described in the case studies that follow of Xerox Corporation and Toyota Motor Manufacturing USAInc. These companies have followed two different strategies for implementing and enhancing reusable shipping container programs.

CASE STUDY: Xerox Corporation

Xerox has switched from a system that used thousands of different size one-way shipping containers to a system that relies on nine different standard reusable corrugated package sizes. By developing standardized, reusable shipping containers, Xerox has created a distribution system in which any of its facilities or suppliers worldwide can reuse the same boxes.[17]

The key features of Xerox's distribution system are:

- **Standardized containers and long-distance supply** Xerox requires suppliers to use standardized containers worldwide.
- **"Open-loop" network** Xerox operates an "open-loop" distribution network in which containers need not return to their point of origin.
- **Third-party collection** A third-party handler collects, sorts, and resells empty containers where they are needed, eliminating the need to haul containers back to their point of origin.
- **Just-in-time** Xerox's system is compatible with just-in-time delivery.
- **Savings** Reuse has enabled the company to save on packaging, disposal, and other costs.

Background: Inefficient use of containers

Xerox Corporation is a multinational producer of copiers, printers, facsimile machines, computer software, and other electronic products that are sold in over 130 countries. The company has major manufacturing facilities in the United States, Canada, England, Holland, France, Japan, and Mexico and in South America.

In recent years, international competition has led Xerox to reevaluate its worldwide operations and costs. Xerox looked for the potential for change and savings in many facets of its operations, including its supplier packaging program. Beginning at its manufacturing and research facilities in Webster, New York, the company examined how supplier parts were being shipped to its facilities worldwide and ultimately instituted the worldwide standardization of the packaging used to ship Xerox component parts.

The Webster facility receives component parts from more than 400 suppliers. While the company has been working to localize its supplier base, it still receives many types of parts from Europe and Japan. In the past, each component shipped to Xerox was packaged in a box unique to that part. This resulted in the shipment of thousands of different types of boxes with as many as 24 different pallet sizes. The use of non-standard packaging resulted in a number of inefficiencies and costs that included:

- **Waste disposal** costs Because different suppliers used a variety of different packages, these packages and pallets reached a "dead end" as soon as parts were delivered to Xerox plants - that is, Xerox was not able to reuse them. Xerox reported spending over $500,000 to send more than 4 million boxes to landfills each year.[18]
- **Operational** costs Xerox often had to repack incoming component parts into new boxes that fit onto racks in its assembly-line operations. Also, unit loads of boxes sometimes required repalletization for movement within the plant.
- **Packaging** costs Worldwide, Xerox had to spend $100 million annually on new corrugated boxes and pallets for its shipments of supplier parts and finished goods. This was because the diversity of the old incoming boxes, many of them unique to the parts they carried, made it impossible for Xerox to reuse them to ship parts between plants or to repair centers.
- **Inefficient use of freight** The use of boxes and pallets of many different sizes prevented Xerox's suppliers from fully utilizing the space of transport vehicles. Since Xerox pays the cost of shipping from its suppliers, this led to freight costs that were higher than necessary.

In seeking solutions for these problems, Xerox saw great opportunities for change in its distribution packaging system, not only at the Webster facility, but worldwide.

Planning Xerox began developing its box reuse program (called the 88P311 Supplier Packaging Program) in April 1989. The company brought together packaging engineers from Xerox and its international suppliers to achieve a consensus on box style and to help make boxes consistent from country to country. Quality control engineers, parts buyers, line engineers, assembly-line workers, suppliers, and box makers took part in the planning process, and senior manufacturing management gave its final approval.

Standard boxes and pallets The core of the program consisted of designing nine standard corrugated cardboard boxes of different sizes and two standard wood pallet sizes that suppliers must use for shipping component parts to Xerox. Xerox makes exceptions where weight, size, or safety pose limitations. The standardized corrugated boxes and pallets can be used at any Xerox facility and are designed to fit directly into designated positions on the assembly line. According to Xerox, "With the use of standard containers, assembly line layout and storage rack compatibility within all Xerox facilities worldwide will be ensured." [19]

New delivery schedules Besides changing the boxes and pallets, Xerox also reworked its delivery schedules. Previously, large quantities of parts were delivered on a weekly-to-monthly basis and put into inventory at on-site warehouses. To replace this system, Xerox developed a just-in-time inventory program based on direct deliveries to assembly-line operations on an as-needed basis. Deliveries are now made on a daily or weekly basis, minimizing the amount of storage and warehouse space Xerox needs.

Xerox also introduced scanners and a uniform bar code labeling system to speed up the throughput of incoming supplies and to reduce errors and invoicing time. (Bar codes are electronic labels that replace paper invoices and that contain such information as the contents of the package, name of supplier, date, etc. Uniform bar codes could also be used with one-way boxes.)

Distribution and third parties Under the new distribution system, as incoming shipments of supplier parts are received and used in assembly-line operations, boxes are collapsed and stacked. Xerox then either uses them in its "internal pipeline" to ship subcomponent parts to other Xerox facilities or repair centers, or returns them to third-party box distributors who sort and resell them to Xerox suppliers.

Xerox uses three box distributors in the United States, one on each coast and another in the Midwest. Boxes shipped from overseas enter one of the three US distribution loops once they are unpacked. A box shipped from Europe or Idaho to New York, for example, enters the east coast distribution loop.

On the east coast, Xerox contracts with H.P. Neun Company, Inc., a private manufacturer of corrugated and set-up boxes located in Fairport, New York, a few miles from Xerox's Webster facility. In the past, Xerox had purchased its own new boxes from Neun. Under contract agreements, Neun now sells both new and used boxes to Xerox's suppliers at a set rate. Neun buys the new boxes from the Jefferson Smurfit Company in Chicago, Illinois, at a price negotiated by Xerox. New boxes cost an average of $0.50 per box for 10,000 boxes. Neun in turn sells the boxes, whether new or used, to Xerox suppliers at an average cost of $1.00 per box. (Actual box costs for suppliers range from $0.19 to $14, depending on box type.) The boxes average eight uses. Neun recycles boxes that are too dirty (e.g., greasy) or damaged beyond repair.

Neun has 10 full-time employees responsible for handling returned boxes. They remove or cross out bar-code labels from the used boxes, put boxes needing repair into a repair bin, and separate for recycling those boxes that are no longer useful. Boxes to be used again are shrink-wrapped or banded and sent out to suppliers. Since they are standardized, the reused boxes do not necessarily go back to the same supplier.

According to Robert R. Vannozzi, packaging commodity team contracting specialist at Xerox, Xerox chose to work with a third party rather than working directly with suppliers to return boxes because of existing logistics. Xerox's distribution loops were already in place, and changing them to require suppliers to haul back empty containers would have been very difficult: many of Xerox's suppliers are located far away and use common carriers to deliver parts. On the other hand, Vannozzi says that a company just starting operations would be able to develop its distribution system from scratch, with dedicated carriers and back-hauling in mind.

Cost is another reason for using third-party companies. Neun can do things cheaper than Xerox because its labor and overhead costs are lower. For example, Neun employees are paid $8-10 per hour to handle box returns.[20] Employees doing the same work at Xerox might be paid $12- 15 per hour. Neun provides similar services for other companies, including General Motors.

According to Vannozzi, Neun works well with Xerox because of its proximity. The program would be much more expensive to operate if the third party were further away. Xerox works with another third-party company to handle returns of its standardized pallets.

Working with suppliers Xerox worked closely with its suppliers in implementing the standardized packaging program. Xerox developed a "Supplier Packaging Agreement Form" that specifies how parts should be delivered to Xerox facilities and describes under what circumstances exemptions are allowed. Xerox also developed a videotape for suppliers that explains the program in detail. Xerox helped suppliers defray some costs by supplying free software for using the new bar-code system.

For some suppliers, the switch to standardized packaging meant an increase in packaging costs, especially if they had been using lighter weight corrugated boxes. In some instances, suppliers passed the higher cost of packaging along to Xerox in the form of increased prices per part. On the other hand, suppliers that were already using more expensive, better quality corrugated boxes are now getting boxes of similar quality for less money. This is because H.P. Neun is able to buy them at lower rates due to the economy of scale in making large purchases.

According to James E. Baxter, Jr., manager of technical services, Xerox had to promote its standardized packaging program to suppliers worldwide. A large company such as Xerox may find this a relatively easy thing to do, since in many cases its purchases represent a major portion of its suppliers' sales. Where this is not the case - for example, Xerox might represent only 1 percent of a screw manufacturer's business - getting suppliers to switch to standardized packaging may be more difficult.

Savings

Xerox's Jim Baxter conservatively estimates that the new packaging program saves Xerox's manufacturing facilities between $2-5 million annually.[21] While Xerox did not provide INFORM with a breakdown of its actual costs and savings, the company did describe six areas in which it is seeing or expects to see savings:

- **Reduced freight** costs Standard sized boxes and pallets "cube out" cargo ship containers and trailers more efficiently, allowing Xerox to pay lower freight costs.
- **Reduced damage** According to Xerox's Jim Baxter, the new boxes offer better protection and have resulted in a significant reduction in damage to incoming parts.
- **Avoided disposal** costs Xerox estimates that 60-80 percent of all incoming parts can be handled with the new system, eliminating the need for 2.4-3.2 million boxes and millions of pallets annually at its Webster facility alone.[22] According to Vannozzi, the company has saved $1.5 million in avoided pallet disposal costs since 1990.
- **Reduced packaging costs** Xerox does not have to buy as many boxes for shipping between its plants, and using standard container sizes allows for a large

leveraged purchase contract with the box manufacturers.

- **Reduced labor** costs The uniform bar-code system has enhanced the accuracy of Xerox's materials tracking and receiving, leading to reduced labor needed for handling and administration. Xerox has also reduced its labor costs because workers do not have to repack parts into boxes compatible with assembly-line operations.
- **Reduced storage** costs Xerox's Supplier Packaging Program and just-in-time delivery system has enabled Xerox to reduce its packaging inventory and reduce warehouse space, allowing the company to use this space for other purposes. Suppliers have also realized savings from reduced packaging inventory.

A ro/e for plastic reusable shipping containers

According to Jim Baxter, the current packaging program is an intermediate step toward Xerox's long-term goal of localizing its supplier base and using reusable plastic containers in a closed-loop distribution system. Baxter indicates that Xerox initially chose reusable corrugated boxes because they are cheaper than reusable plastic. According to Baxter, the initial cost of buying plastic containers was too high to justify before the whole distribution system has been worked out.

Bob Vannozzi says that plastic containers, which would last longer than the corrugated boxes now in use, are more practical when suppliers are mostly local and where there is a tightly closed distribution loop. "Controlling the loop is a major problem," says Vannozzi. The boxes are subject to theft because they are of such good quality, but closed-loop distribution helps to minimize this risk.

Hybrid system? According to Baxter, Xerox might eventually develop a hybrid system in which reusable plastic containers are used with local suppliers and reusable corrugated containers with long-distance suppliers. Localized supply has other advantages besides better control over containers, says Baxter. While parts ordered from overseas may be cheaper, they include many hidden expenses, such as: the cost of long distance phone bills and air freight; little flexibility in distribution frequency and inventory; and quality control problems. In other words, the cost of dealing with a distant supplier may lead to higher overall costs. According to Baxter, "in the end it boils down to price per piece versus total acquisition costs."

Other goals

Standard dunnage Xerox has worked to remove the expandable polystyrene dunnage used in boxes to protect parts and to replace it with corrugated cardboard, which is more easily recyclable. However, with the new standardized box system, suppliers may have to insert more dunnage than before to secure their products, and this may be more expensive than the box itself. The dunnage inserts are not standardized and are typically discarded after one use. Xerox is working on the development of standard reusable inserts, possibly made of plastic.

Palletless? The Supplier Packaging program allows Xerox to reuse and therefore use fewer new pallets, but pallets still represent a major cost for the company. Switching from wood to a more durable plastic pallet would save money over time but, as is the case with reusable plastic containers, the initial costs are high. Anew plastic pallet costs about $38, compared with $5-6 for wooden pallets. Eventually, Xerox might experiment with palletless shipping. According to Vannozzi, this would require switching to clamp-type forklift trucks at all loading and receiving locations. In the long run, this might save millions of dollars.

CASE STUDY: Toyota USA

Toyota, Japan's largest auto manufacturer, began making cars in the United States in 1988. Toyota's initial blueprint for its US auto manufacturing operation involved a distribution system based on the use of reusable shipping containers, which the company was already using in Japan. But Toyota USA encountered obstacles that its parent company did not face in Japan.

In implementing its reusable shipping container system, Toyota has applied a philosophy known as kaizen, which means striving toward continuous improvement. This approach has helped Toyota USA find a number of opportunities to increase efficiency and lower transportation costs.

Toyota's distribution system relies on the frequent delivery of standardized reusable shipping containers. The key features of Toyota's system include:

- Standard container and pallet sizes that maximize space in transport vehicles

- Containers that fit into its assembly-line operations
- Reliance on dedicated carriers that make daily deliveries and pickups of empty containers, facilitating the smooth distribution and hauling back of containers.[23]

Toyota's reusable shipping container system has enabled the company to save in at least two areas:

- Reduced freight costs, by over $3 million annually
- Avoided disposal costs

Background

Toyota Motor Manufacturing USAInc. began mass-producing Camry Sedans at its 3.7-million-square foot manufacturing facility in Georgetown, Kentucky, in 1988. In 1991, 4,000 Toyota team members (the company's term for its employees) produced 200,000 vehicles. A 3.2-million-square foot expansion is expected to double production by 1995.

When Toyota began operations at its Kentucky facility, it developed a distribution system with reusable shipping containers in mind, adapted from its main operations in Japan. Dedicated carriers - trucking companies hired to work solely with Toyota - were assigned specific routes for daily pickups of parts from suppliers. A just-in-time delivery system helped to ensure a rapid turnover of full and empty containers, allowing for cost-efficient hauling back of containers. Toyota further enhanced this system by increasing its use of domestic suppliers and by working with suppliers to develop a standardized container system.

Local Suppliers Toyota purchased $1.2 billion in parts made by US companies in 1992, up from $70 million in 1988. About 90 percent of these suppliers are located within 500 miles of the Georgetown plant.[24] The use of local suppliers has helped the company to increase its use of reusable shipping containers, because smaller distances facilitate the return of empty containers.

New cars, new containers When Toyota planned for a major model change in 1991, it also planned a new distribution packaging system. Toyota developed the new container system with the following goals:

- **Standardize reusable containers and pallets to maximize cube efficiency in trailers** Previously, the use of many non-standard shipping containers resulted in much lost or dead space in the trucks making deliveries, leading to higher freight costs for Toyota.
- **Design containers to be ergonomically compatible** Containers were designed for material loads within the 40-pound limit required by Toyota for manual handling, with hand grips to minimize the risk of repetitive motion disorders.

Design new containers Toyota developed the specifications and standards for its new containers and worked with container manufacturers to design them. Toyota requires its suppliers to purchase and maintain these containers, which include plastic crates, metal racks, and corrugated cardboard boxes with plastic lids. According to Toyota, initial purchase of the new containers cost suppliers $8-10 million overall, with costs per supplier ranging from $1,000 to $1 million, depending on the number of parts they were shipping. While suppliers make the initial investment, over time they recoup this cost from Toyota, the automaker says. Toyota says that some reusable containers may last up to 20 years and may make 30 to 40 trips per year, depending on the number of deliveries suppliers make each day.

Toyota worked closely with one container manufacturer, LEWISystems in Watertown, Wisconsin, a division of Menasha Corporation, which supplies the containers for about 50 percent of all Toyota's parts. LEWISystems also worked with Toyota's suppliers and helped defray costs by buying back old containers or swapping new containers for old ones. LEWISystems' containers are plastic totes designed for manual handling that conform to Automobile Industry Action Group standards and Toyota's 40-pound maximum weight limit.

Toyota uses about 30 different types of containers, varying in size and weight from small totes that weigh one pound to bulk bins that weigh up to 500 pounds. Individual containers are designed in 15-inch increments so that, regardless of size, they fill out standard sized pallets that are 48 inches long and 45 inches wide. The pallets themselves are designed to utilize maximum space to "cube out" standard size trailers that are 48 feet long, 90 inches wide, and 96 inches high.

Reusable dunnage Many of the containers are designed with custom dunnage which, besides protecting parts inside the containers, improves handling efficiency on the assembly line by positioning parts for fast removal. Suppliers reuse about 90 percent of the dunnage Toyota uses. The dunnage itself - polystyrene, high density polyethylene (HDPE), or other molded plastic partitions -typically lasts from three to five years.

Distribution

Toyota uses three trucking companies that own and operate trailers dedicated to the company's routes; each

trailer may make deliveries 2-to- 16 times per day. In total these carriers travel approximately 70,000 miles per day at a freight rate of $1.30 per mile, or about $91,000 per day. Toyota suppliers that use reusable containers are located as far away as Quebec (1,700 miles).

Distribution is set up so that, with each delivery, trucks bringing supplier parts to Toyota pick up empty shipping containers. At Toyota, as container or pallet loads of materials are carried to the production line, empty containers are returned to a designated storage area where they are palletized and loaded onto trucks for back-haul to suppliers. On the production floor, full containers are placed on "gravity flow racks" - slopes that allow containers to slide down to the assembly line by the force of gravity. Assembly-line workers return empty containers to "reverse flow racks" for pickup and return to storage. Dunnage remains inside the containers for return shipment, saving labor for both Toyota and the supplier.

As suppliers are responsible for their own containers, the containers are hot-stamped with the suppliers' names to ensure that they get back to them. Toyota reports very little container loss - about 3 percent annually due to damage or misplacement within the plant. Since all containers are delivered by dedicated carriers, loss due to theft or misdelivery is not a big problem.

Impact

By standardizing its container system, Toyota has been able to increase its space efficiency in trailers by 21 percent. According to Toyota, this has resulted in a savings of more than $3 million in transportation costs, or approximately $18 for each vehicle built. Toyota sees further opportunity to increase space efficiency inside trucks by designing containers to hold more parts without going over the 40-pound limit and by marking pallets better so that they are not loaded incorrectly onto trucks. Toyota hopes through its current review process or kaizen to reduce transportation costs by an additional 15 percent.

Waste Toyota has not calculated the amount of waste reduction achieved by increasing its use of reusable shipping containers. In general, it reports a reduction of waste going to landfills, due in part to continually reducing the amount of disposable material that enters the plant and to its in-house recycling efforts. Manufacturers of reusable containers generally take them back when they become unusable, grind them up, and recycle them into new containers.

Manufacturing: Challenges for smaller companies

The two case studies above describe the programs of large multinational corporations. Smaller manufacturers, however, may face greater difficulties in switching to reusable shipping containers. John Okun is waste reduction and recycling director of the Long Island City Business Development Corporation, a non-profit organization dedicated to the preservation and enhancement of business opportunities for companies in western Queens, New York. Okun reports that some of the manufacturers and distributors with whom he works find that a number of obstacles often make it impractical to switch to reusable containers. These obstacles may include high initial costs and resistance on the part of suppliers and customers. Besides the expense of investing in a float of containers, Okun states that "often, labor and handling costs increase in the short run when a reusable shipping container system is established."

The purchasing habits of smaller companies may also pose an obstacle. Smaller companies often purchase materials in small quantities, too small to give them much clout with suppliers. Or companies may purchase their materials from spot markets, often overseas, which offer substantial purchasing savings but little flexibility in terms of shipping medium distances. Similarly, Okun reports that smaller manufacturers don't represent a large enough source for some of their customers. These customers may have rigid receiving policies which preclude switching to reusable shipping containers. One solution, Okun suggests, may be for several small to medium companies to purchase raw materials cooperatively, thereby gaining the clout to persuade suppliers to ship materials in reusable containers.

Another factor for smaller companies may be storage costs, as maintaining a supply of shipping containers requires additional space. "This is especially true during the transition period from disposable to reusable containers or where companies have relationships with some customers that preclude the use of reusable containers," Okun says.

Freight costs sometimes increase, too, when companies haul back empty containers to suppliers. In addition, companies that adopt reusable shipping containers may find that savings in waste disposal costs lag behind any reduction in generation of waste materials.

But in the long run, "costs for packaging and disposal decrease, and product damage is minimized," Okun says. "These savings tend to offset cost increases in labor and

handling, freight and storage. But again, it is often the size of the firm and quantity of materials involved that determines bottom-line benefits." [25]

Working with business intermediaries

Local development corporations, small business development centers, and trade associations may play a role in encouraging industry standardization of shipping containers and cooperative efforts to work with suppliers. According to John Okun of the Long Island City Business Development Corporation, business intermediaries may be better suited to play such a role than many government agencies. Companies that fear government agencies' regulatory powers may be more comfortable working with a business intermediary on issues related to switching to reusable shipping containers. In addition, business development centers and trade associations can provide varied assistance for companies that want to implement reusable shipping container programs in general and standardized container systems in particular.[26]

IV. Case Studies in the Grocery and Supermarket Industry

The food and beverage industry received more shipments in corrugated boxes than any other industry in 1993 (see Figure 2). Food Marketing Institute surveys indicate that old corrugated containers (OCC) can make up about 84 percent of a large supermarket chain's waste and 46 percent of a smaller operation's waste.[27] Nearly 80 percent of grocery distributors and retailers have OCC recovery programs. But about 30 percent of grocery store OCC is not recyclable because it is waxed or contaminated.[28] Even when recycling OCC would generate revenue, the labor and handling costs of preparing the material for recycling may exceed that revenue.

Waxed corrugated containers used to ship fresh produce make up 3-5 percent of the OCC stream, accounting for about 17 percent of all grocery waste, according to the Grocery Manufacturers Association's committee on solid waste.[29] The produce industry alone disposes of 100-200 million waxed boxes per year.[30] According to Franklin Associates, between 1972 and 1987, corrugated containers used for produce constituted the fastest growing segment of the corrugated packaging waste stream for food and kindred products.[31]

Reuse: Opportunities and obstacles

Does the reuse of shipping containers offer opportunities for reducing the grocery industry's waste stream of corrugated boxes? What types of distribution systems are most compatible with this switch? To answer this, INFORM spoke with representatives of two product manufacturers, five large supermarket chains, a small chain of food cooperatives, a reclaimer of empty produce boxes, and a company that manufactures and leases standardized shipping containers.

INFORM has identified two kinds of distribution systems that are compatible with reusable shipping containers and one industry segment in particular that has shown increasing interest in reusables:

- **Direct delivery from product manufacturer to store** Many grocery goods are distributed through warehouses, but direct delivery to stores is still common in the milk, baked goods, and soft drink industries and in cases where supermarkets run their own production facilities. The manufacturer ships products either to its own stores or to other companies' retail outlets.
- **Break-bulk operations** When individual stores order in quantities smaller than full cases of products, distributors may unpack bulk cases and repack products in smaller boxes for store delivery.
- **Produce industry** The waxed cardboard commonly used for produce is not recyclable,[32] so reusable containers can save retailers money in disposal costs and also save growers money in reduced packaging expenses.

Implementing an industry-wide reusable shipping container program presents a significant challenge for the manufacturers, wholesalers, and retailers involved in the production and distribution of grocery goods. In general, a number of factors related to grocery distribution currently work against a comprehensive reuse system, including the following:

- **Investing in a large enough float of containers is expensive.** Switching from single-use to reusable shipping containers requires a large initial investment. Not only may reusable containers cost 2-to-20 times more than single-use containers, but manufacturers may need to start with one-and-a-half to three times as many because they need a steady supply of containers to compensate for those in transit. According to one container manufacturer, the capital investment may be hard to justify, especially in times of recession.[33]
- **The cost of return freight to haul back empty containers may be prohibitive.** Most product manufac-

turers do not own their own trucks but, instead, contract out to common carriers. After making deliveries, these carriers usually pick up additional loads for other companies. To accommodate a reusable container system, common carriers may need to change routes or add extra trucks to haul back empty containers - adding to the cost of such a system and possibly making it uneconomical.

- **Ensuring the return of containers is difficult.** A national manufacturer may deliver hundreds of different products to thousands of distribution warehouses and stores across the country. As common carriers typically distribute these goods, it is difficult to control an individual manufacturer's pool of containers. And because reusable shipping containers tend to be valuable, concerns about theft are great. Even when a company uses its own trucks, ensuring the return of containers may be a problem.
- **Tracking containers may be difficult.** As thousands of different product lines may pass through a supermarket's distribution warehouses and stores, tracking individual companies' containers would be an added expense and administrative burden - especially if the system entailed deposits for empty containers.
- **Adequate storage facilities may not be available.** The lack of secure storage space for empty containers presents another problem. According to one supermarket industry source, today's stores have less available back-room space than stores had in the past.[34]

Distribution systems in which reusable shipping containers are common

Despite these barriers, INFORM has identified two distribution systems in which reusable shipping containers are commonly used to ship grocery products today: direct store delivery and "break-bulk" operations.

Direct store delivery

Most grocery products are shipped to stores in the United States by wholesalers, via distribution warehouses that may store thousands of different products. However, some products are shipped directly from the point of manufacture to individual stores. Perishable items such as milk and bread are shipped frequently and directly to stores to ensure freshness. Soft drink companies traditionally have also shipped their products directly to stores from bottling facilities or company-owned warehouses.

The milk industry Single-use corrugated shipping boxes do not work well in the milk industry for two reasons. First, milk must be kept cold while shipped, and with condensation, corrugated cardboard becomes too soggy to hold the weight of the milk containers. Second, milk is a perishable product that is delivered frequently to the same locations. This means that dairies, which make frequent round trips, save money on packaging by opting for reusable cases. Today most dairies use plastic cases, which began to replace wood in the 1960s.

Stewart's Processing Corporation's Saratoga Dairy (Saratoga Springs, New York) ships one-way and refillable milk bottles and cartons in plastic shipping crates to Stewart's 200 convenience stores. On return runs, the company's trucks haul back empty milk bottles in the same crates. According to Stewart's management, this kind of back-hauling does not add significantly to the company's transportation costs.[35]

Soft drink industry The soft drink industry traditionally has maintained direct store delivery from bottling plants to stores, sometimes via company-owned distribution warehouses. As the industry as a whole moved from refillable to one-way primary packaging, it abandoned reusable transport packaging. However, this is starting to change. The Pepsi-Cola Company has shipped its 2-liter bottles in reusable plastic crates since the mid-198Os, and the company currently uses them for 80-90 percent of these deliveries.

Pepsi-Cola delivers its beverages directly to retailers in company-owned trucks. Company personnel unload and stock the product on shelves and take back empty crates. Sometimes workers leave crates in the stores until the next delivery, where they form displays at the end of aisles. (The loaded crates are designed to stack together.) In some instances, Pepsi-Cola charges stores a deposit of $1.OO for each crate.

Reusable crates cost less per use than single-use corrugated boxes. One-way cardboard cartons cost $0.25-$0.30 apiece. The plastic crates cost Pepsi-Cola about $1.60 each and may average 100 uses. Over the course of its useful life, the reusable crate costs $0.016 per use, nearly $0.26 less per use, on average, than a single-use corrugated box.

According to S.P. (Sal) Porrazzo, Pepsi-Cola's director of environmental affairs, the plastic crates are also more durable and can be stacked higher, thereby taking up less floor space than corrugated containers. Pepsi-Cola estimates that switching to plastic has eliminated 80-90,000 tons of corrugated waste per year.[36]

Pepsi-Cola may begin to ship cans and bottles of other sizes in reusable crates as well. The company is testing prototypes of crates for 16-ounce glass and plastic bottles and 12-ounce cans in northern California. However, Porrazzo says that getting reusable crates back from consumers who buy a case of 24 cans is sometimes a problem, because there is no deposit.[37]

Products manufactured or prepared at supermarkets' own production facilities Some supermarkets and convenience stores make or prepare their own line of products at facilities near the stores' distribution centers. This arrangement allows companies to deliver directly to their stores and avoid third-party distributors.

H. E. Butt Grocery Company (San Antonio, Texas) - the largest family-owned grocery company in the United States, with 235 stores -produces or prepares many of its own items in manufacturing facilities at its distribution centers. According to Linda Smith, the company's manager of environmental affairs, H. E. Butt packs its baked goods and dairy items in plastic, reusable shipping containers. After receipt at the store, the containers are emptied and returned to the distribution centers by returning H. E. Butt trucks. The company's manufacturing facilities are equipped with conveyors and washers that prepare and clean the reusable containers before they are returned to the appropriate facility.[38]

Wakefern Food Corporation, the merchandising and distribution arm of ShopRite supermarkets in Connecticut, Delaware, New Jersey, New York, and Pennsylvania, uses reusable containers to ship fish directly from its distribution warehouse, where it cuts up the fish for shipment to its stores.[39]

Break-bulk operations

To accommodate individual stores that order products in quantities smaller than a full case, distributors at supermarket warehouses or third-party wholesalers may "break up" the bulk cases - mostly corrugated boxes - and repack products in smaller boxes for delivery to stores. Some supermarket distributors have found it more economical to repack these smaller loads into reusable shipping containers.

Wakefern Food Corporation has been using nestable, reusable plastic totes for about 15 years. The company uses the totes to send orders of various products, such as household appliances and health and beauty aids, from its general merchandise warehouse to individual stores. When a store orders less than a whole box's worth of a particular product, Wakefern repacks the products from cardboard boxes into the totes. The totes save Wakefern money on packaging and labor. A separate company repairs the totes, which may last for seven or more years. Wakefern trucks bring all totes to and from its stores.

Hannaford Brothers provides another example of break-bulk operations. The company, which has 93 supermarkets in Maine, Massachusetts, New Hampshire, New York, and Vermont, currently uses reusable totes for repacked health and beauty items and to deliver in-house sanitation supplies. When health and beauty items are shipped to Hannaford's warehouse, the company repacks them in reusable totes for specific store orders[40]

Shipping produce in reusable containers: Three different systems

Besides the direct delivery and break-bulk settings described above, some retailers have shown increasing interest in reusable produce containers in place of waxed cardboard. Because waxed cardboard is not currently recyclable, the retailers view reusable containers as one way of cutting disposal costs. The following case studies describe three different solutions for reusing produce containers. The Puget Consumers' Co-op (PCC) in Seattle, Washington, worked with a local produce grower and a wholesaler to develop a pilot program in which reusable plastic containers are used in a closed-loop distribution system. The second case study describes the operations of Dom's Empty Package Supply Inc., in New Paltz, New York, which reclaims nonrecyclable produce containers from grocery stores and supermarkets and sells them for reuse. The third case study describes the German-based International Fruit Container Organization's development of a standardized industry-wide reusable plastic container system for shipping produce in Europe.

Puget Consumers' Co-op: A local distribution network

PCC is a 36,000-member food cooperative that owns and operates eight stores in Seattle, Washington. The co-op received a grant of $10,800 from the Seattle Solid Waste Utility to develop a pilot project using reusable shipping containers to distribute fresh produce.[41] PCC used most of the grant money to buy 800 reusable plastic containers to replace nonrecyclable wax-coated corrugated boxes[42]

PCC tested the reusable plastic shipping containers in a limited distribution system that shipped produce from a local organic grower, Rent's Due Ranch (Stanwood,

Washington), to a local wholesaler, Rosella's Produce (Seattle, Washington), and to PCC. As part of the test, Rent's Due used reusable containers to ship cases of produce (leaf lettuce, zucchini, squash, peas, broccoli, and beans) from Rent's Due to PCC.

How it works Rent's Due Ranch packs freshly picked produce into the reusable containers, which it holds in cold storage until Rosella's picks it up. Five days a week, Rosella's takes the produce from Rent's Due and delivers it to PCC stores, then hauls back the empty containers to Rosella's warehouse. PCC and Rosella's use an invoice system to track each time a full container is exchanged for an empty one. PCC is Rosella's only customer using reusable containers, so accounting for the containers is a relatively simple job. Rosella's ships empty containers to the grower as needed.

The containers, made by Buckhorn Manufacturing in Milford, Ohio, are nestable when empty, for space-efficient storage, and have an open lattice-work bottom that allows for air circulation and drainage.

Project goals One goal of the project was to reduce the amount of waxed cardboard PCC was discarding. PCC estimated that waxed cardboard produce boxes made up 16-18 percent of its stores' waste stream, with disposal costs ranging between $30.84 and $41.57 for every $100,000 of store sales. All told, PCC was spending $170-$229 per month on disposal of waxed cardboard produce boxes.

A second goal was to reduce Rent's Due Ranch's packaging costs. Single-use waxed cardboard boxes represented a significant cost for the grower, in part because it can afford to buy only a small volume of boxes at one time. At $1.50 apiece, the cost of the box itself made up 25 percent of the wholesale cost of a case of lettuce during peak growing season.

Less garbage but no immediate savings for PCC Reusable containers reduced PCC's waste stream, but this reduction was not enough to lower the co-op's disposal costs. This is because PCC's waste hauler charges on the basis of the number and volume of dumpsters collected from PCC monthly, not by weight. To reduce disposal costs, PCC must cut its waste volume enough to allow it either to reduce the number of times its waste is collected weekly or to switch to a smaller dumpster. PCC estimates that it could save $115 per month, or 12 percent of total disposal costs, if it could switch 45 percent of its produce shipments from waxed cardboard to reusable containers; other retail stores of similar size might show similar savings, according to PCC.[43]

Growers do better The project demonstrated that growers could save substantially in shipping container costs. PCC estimates that over a five-year period, the expected useful life of the reusable containers, a small grower could save more than $40,000 in packaging costs and recoup its initial investment within four months.[44]

Other advantages PCC reports that the reusable containers protect produce better than waxed cardboard and are easier for wholesalers to handle and ship.

Obstacles to broader use PCC identified a number of obstacles that must be overcome in establishing similar programs, including the large initial investment required; the risk of container loss, particularly in a system with multiple growers and retailers; an efficient and frequent back-hauling system; and lack of storage space in stores.

PCC told INFORM that it would like to expand the produce shipping program and find other farmers willing to participate. PCC would like to develop a partnership with the grower that would pay for additional reusable containers, since the grant money will have been spent. Those parties that would receive greater savings would pay for a greater percentage of the containers.

The PCC case study shows the advantages of using reusable shipping containers in a tightly controlled, locally-based distribution system. Even for seasonal markets, switching to reusables makes sense economically. However, according to Ted Brown at Hannaford Brothers, reusable shipping containers are not appropriate for shipping goods from far away.[45] Lettuce, for example, is shipped to Hannaford's New England stores from California and Florida, making back-haul of containers expensive. Brown adds that while Hannaford is considering using reusable containers for locally shipped produce, produce is not available from local growers year-round.

Dom's Empty Package Supply: An "open-loop" reuse system

James A. Badami, president of Dom's Empty Package Supply Inc., in New Paltz, New York, has overcome the problem of reuse and long-distance distribution by developing what he calls an "open-loop" reuse system. Badami's business reclaims used produce containers from stores and sells them back to growers, who can use them again. The business collects a wide variety of produce containers destined for disposal, including: wire-bound wooden crates, waxed corrugated cardboard boxes, plastic one-pint strawberry baskets, and polystyrene foam. These containers are generally not accepted by recyclers;

but even though they were intended for just one use, they are durable enough to withstand further use for shipping produce or other items. Badami says that wooden wire-bound boxes constitute his biggest market. He estimates that he handles more than a million of the 80-90 million wire-bound boxes that are manufactured in the United States each year.[46]

Dom's was founded in 1941 by James Badami's father and today employs 18 people. Dom's recently added a 5,000-square foot building next to an already standing 6,000-square foot facility. "Supply and demand was the basis for the creation of a reuse business in the 194Os," he says. Today, Dom's service "is still in demand" for small growers and farmers who save money by buying used instead of new containers.

Savings for growers Badami describes his operation as an open-loop system. At a supermarket in New York, Dom's may reclaim a one-bushel bean crate that originated in Tennessee, then sell it to an onion grower in Maryland or a clammer in New England. Badami has no idea how many times individual boxes are actually reused. In some cases, growers buy the used boxes, which then reenter the loop. In other cases, a buyer uses a box in such a way that it may not be possible to reclaim it for future use. For example, Dom's may reclaim a box that was used to ship grapes from California to the east coast and sell the box to a nursery that uses it as a planter. Or a consumer may bring the box home from the store filled with fruit. In either case, there is no further possibility for reclaiming the box as part of the produce loop. Trying to monitor the movement of a specific container over its useful life would depend on the cooperation of too many different people and would add to the cost of reusing the container, Badami says.

Dom's has as many as 200 customers, some as-far away as Florida, Canada, and California. In some cases, Dom's ships reclaimed containers in its own trucks; in others, customers come to pick up containers. Sometimes Dom's ships containers back to their point of origin. One California grape grower buys back its own boxes from Dom's at about 50 percent of the cost of new boxes.

Retailers save on disposal costs In addition to helping growers save money, Dom's saves large retailers money in avoided disposal costs. Badami says that he is saving one large supermarket chain $25,000 a month in disposal and related costs by collecting its nonrecyclable produce containers. The 41 chain stores, located in New York and Northern New Jersey, pay him to pick up the boxes but save money because, according to Badami, his fee is cheaper than the cost of paying a compactor's fee plus transport and landfill tipping fees.

Still, Badami has had a hard time convincing some retailers that his service makes sense. "Many of them think that putting [the boxes] in the dumpster is the cheaper way to go," he says. Another problem is that many localities do not require stores to separate reusable items from trash, even in areas with source-separation laws. And some source-separation laws specifically exclude waxed cardboard. As a result, many retailers feel no obligation to separate these boxes from their trash, even though reclaiming the boxes would keep them out of landfills or incinerators.

Nationwide potential Badami believes that his type of operation could be replicated easily. He believes that government at all levels could help in the creation of similar businesses by:

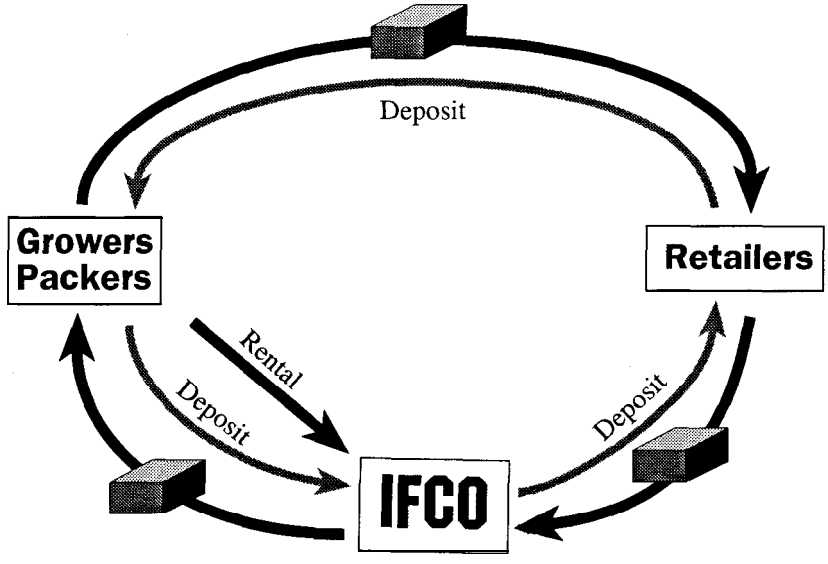
- Creating an awareness of the importance of reuse in reducing the waste stream
- Establishing a network of reuse markets so that growers, shippers, and distributors can be put in contact with reclaimers
- Mandating source separation of reusable containers, such as waxed cardboard and wire-bound boxes
- Providing tax incentives or loan programs to help get businesses started and to stimulate job creation.

Dom's is an example of regional third-party reclamation that can be replicated on a local or regional level anywhere. Within the region, Dom's performs a unique service in keeping a significant quantity of containers out of the solid waste stream - primarily containers that were intended for just one use - at what is, in effect, no cost to stores.

International Fruit Container Organization: Leasing standardized containers

This next case study documents a more sophisticated third-party reclamation system than that of Dom's. It involves leasing standardized reusable produce containers on an industry-wide basis. International Fruit Container Organization (IFCO), a German company based in Munich, makes shipping containers for produce. Schoeller International, a Munich-based company that makes reusable beer and soft drink crates, formed IFCO largely in response to the 1991 German packaging ordinance that makes industry financially responsible for its packages to the end of their life cycles, including the costs of collecting, sorting, and recycling packages after

Figure 3: IFCO 's Deposit System



Source: Schoeller International Group

they are discarded. The goal of the ordinance was to shift the cost of managing packaging waste from the public sector to private industry.[47]

IFCO differs from US manufacturers of reusable shipping containers in two fundamental ways. First, IFCO designs and markets standardized reusable plastic shipping crates not for individual companies but for the fruit and vegetable industry in general. Second, IFCO does not sell crates to growers and packers. Instead, it leases the containers to them.

An industry standard IFCO manufactures its fruit and vegetable containers from polypropylene in seven standard sizes. According to Peter B. Zaboji, president and chief executive officer of Schoeller International, the standardized crates accommodate nearly 75 percent of all produce shipped through the German market.[48] Since nearly 80 percent of the produce consumed in Germany is imported, IFCO also has worked with growers who ship produce to Germany from other countries, including Belgium, France, Israel, Italy, Netherlands, and Spain. During the period from April 1993 to March 1994, over 12 million IFCO containers were reused. According to Zaboji, this translates into a reduction of 100 million kilograms (110,250 tons) of waste. Schoeller has also introduced standardized packaging systems for supermarket dry goods and for eggs, meat, and fish. The company is exploring the feasibility of similar systems for the automobile, book, furniture, and mail order industries.

Standardization simplifies the reuse of packaging in a distribution system by enabling companies to use each others' containers interchangeably, reducing the number of containers any one company must purchase and eliminating the need to haul back empty containers to their points of origin. Standardization also simplifies sorting of container types and accounting for individual containers.

How IFCO works IFCO leases containers to growers and packers of produce on an as-needed basis. After delivery to retail food outlets, the empty containers are collected by a logistics service company hired by IFCO, which cleans, stores, and redelivers empty containers to growers. In Germany alone, the company has 30 depots for reconditioning and storing empty containers.

To be competitive with makers of single-use packaging, IFCO must keep its rental costs lower than the purchase price of single-use containers. For IFCO, this means keeping the cost of storage, handling, transportation, and depreciation lower than the cost of manufacturing and recycling single-use containers. IFCO crates themselves last up to five years and may be recycled at the end of their useful life into new crates.

Deposits are key A grower who leases a container from IFCO leaves a deposit (see Figure 3). The grower then

charges a deposit to retailers when the product is delivered to stores. Retailers redeem their deposits once IFCO recovers the crates. However, these deposits are generally accounting procedures with no money changing hands unless the IFCO containers are lost or stolen. According to Peter Zaboji, deposits help to control the whole process. IFCO reports little loss due to theft.

Savings Zaboji reports that both growers and retailers save by leasing the crates. Growers save on packaging and associated disposal costs and avoid the administrative burden of ensuring that empty containers are recycled or reused, as required by the German Packaging Ordinance. Retailers report better product protection and reduced handling and labor costs in the stores. The crates themselves are collapsible, reducing the volume of space needed to store empty containers and the number of trucks IFCO needs for hauling containers back to its depots.

US potential? Chep USA The German Packaging Ordinance stimulated new reusable packaging systems such as IFCO. However, in the United States, it may be possible to implement third-party container systems in response to market demand, without legislative catalyst. Such a system could reduce many of the costs associated with using reusable packaging outside of a closed-loop distribution system.

Chep USA in Park Ridge, New Jersey, provides plastic pallets through a similar service in the United States and other countries, including Australia, Canada, South Africa, New Zealand, and various European countries. In the United States, Chep operates a national pallet rental service for grocery manufacturers and distributors, mass merchandisers, warehouse clubs, discount drug stores, and fresh produce companies. Chep rents pallets to manufacturers who deliver goods on Chep's pallets to participating distributors. The distributor is responsible for returning the pallets to one of the more than 140 depots that Chep operates nationwide. Chep maintains pallets and helps both manufacturers and distributors track pallets. Donna Gorman of Chep's Marketing Services Department says that the chief benefits of the system are lower damage rates for products shipped; quicker delivery; and elimination of distributors' pallet storage costs.

V. Policy Options that Promote Reuse

Despite the environmental and economic advantages of reusing shipping containers, not all distribution systems easily lend themselves to the efficient use of reusable packaging. As shown in Table 3, most of the obstacles to expanding the use of reusable shipping containers in the United States are financial. Resistance to change is another obstacle. According to Xerox, prior to implementation of its Supplier Packaging Program, many of its suppliers had good long-standing relationships with the companies from which they bought their packaging and so were reluctant to change. As described earlier, convincing suppliers to switch to reusable containers may be an especially difficult task for small businesses that lack the procurement clout of a company such as Xerox.

Promoting reuse: Government options

INFORM has identified at least five government policies that alone or in combination could promote the use of reusable packaging in the United States:

- Government mandates to use reusable shipping containers, including requiring the use of standardized containers
- Economic incentives to encourage reuse
- Government procurement policies favoring reusable packaging
- Manufacturers' responsibility legislation
- Broad materials policies encouraging reuse

Government mandates

Government at any level can require producers or shippers to deliver goods in reusable shipping containers. To facilitate such a mandate, government may also require that each industry use standardized containers so that companies can use each others' containers interchangeably. Standardization simplifies the reuse of packaging in a distribution system by reducing the number of containers any one company must purchase, eliminating the need to haul back empty containers to points of origin, and simplifying the sorting and accounting of individual container types. Government mandates may work best if designed with enough flexibility to encourage other types of packaging innovation, besides reuse, that would reduce material use - for example, selecting a different packaging material or adopting bulk packaging, then encouraging use of recycled content and recyclability.

Economic incentives encouraging reuse

Government at any level can provide financial incentives that help industry switch from one-way to reusable containers. These incentives may include tax credits or low-

Table 3: Expanding Reuse of Shipping Containers: Challenges and Solutions

OBSTACLE	SOLUTION: Industry options	SOLUTION: Government options
Large initial capital expense	Third-party leasing	Low-interest loans, tax credits
Cost of administering system	Third-party leasing Industry-wide standardization of containers	Mandated standardization
Cost of long-distance freight to return containers	Industry-wide standardization of containers	
Resistance to changing packaging and shipping practices	Cooperative effort within an industry to work with suppliers	Government procurement guidelines that favor or require reusable shipping containers
Lack of procurement clout on the part of small business	Cooperative purchasing	
Lack of storage space for empty containers	Collapsible, nestable, and stackable containers Frequent collection of containers Just-in-time delivery Direct delivery	Financial incentives for establishing storage depots, such as loans or tax credits

SOURCE: INFORM

interest loans for container manufacturers, product manufacturers, wholesalers, and retailers converting to reusable shipping container systems. Incentives can also take the form of grants that provide the capital for companies to pilot a reusable shipping container program, as in the case of the PCC project. Incentives would ease the way toward investing in containers and related handling equipment.

Government procurement

Government in the United States is the nation's largest economic sector, accounting for about 20 percent of the Gross Domestic Product and employing one in six workers at the federal, state, or local level. Just as Xerox and Toyota had the purchasing clout to persuade large suppliers to switch to reusable shipping containers, government can use its considerable purchasing power to require suppliers to use reusable shipping containers when shipping to government-run or government-contracted facilities. These may include armed forces installations, schools, hospitals, correctional facilities, and recreational facilities.

Manufacturers' responsibility legislation

In 1991 Germany passed a packaging ordinance that makes industry financially responsible for its primary, secondary, and transport packaging to the end of the packages' life cycles, including the costs of collecting, sorting, and recycling packages after they are discarded. The goal of the ordinance was to shift the cost of managing packaging waste from the public sector to private industry.

One component of Germany's Packaging Ordinance is the requirement that manufacturers and distributors "take back" transport packaging for reuse and recycling independent of the public waste management system. The requirement has led manufacturers and distributors either to arrange for third parties to pick up used packaging or to compensate retailers for managing waste based on the materials and quantities involved. By adding the cost of waste management to the overall cost of single-use transport packaging, the ordinance has encouraged shippers of consumer goods and other products to shift to reusable packaging. Many new reusable packaging systems have been developed for various products, in-

cluding the IFCO system for fruits and vegetables and other container systems for fish, medicine, bicycles, furniture, and the general line of consumer products sold in supermarkets.

Broad materials policies

Establishing broad materials policies, such as taxes on raw materials or energy consumption, can give companies an economic incentive for reducing the environmental impact of material use. The broad goal of these policies is to internalize the environmental costs of an economic activity so that industry absorbs these costs and accounts for them in pricing goods and services. Cost internalization can give industry an incentive to adopt reusable products and packages as one strategy to reduce material consumption.

Incentives to Reuse

As shown in the case studies in this report, the opportunity to save money on packaging, waste disposal, and associated handling costs may be enough of an incentive for some companies to switch to reusable shipping containers. In other cases, the prospect of legislation that would restrict their current waste management practices has led companies to switch to reusable containers. To cite one example, the John Deere Company in Horicon, Wisconsin, switched to plastic reusable transport packaging when Wisconsin passed a law banning corrugated paperboard from landfills and incinerators starting in 1995.[49]

Proposals are surfacing in Congress and in state legislatures to expand manufacturers' responsibility for products and packages to include the cost of recycling and disposal. As seen in Germany, such legislation can provide a strong economic incentive for reuse as a source reduction measure. Some states also have proposed to ban the import of out-of-state waste, which could limit manufacturers' and municipalities' options for sending materials to landfills.

Business may decide to adopt reusable shipping containers for a variety of reasons: as a way of boosting efficiency and saving money on packaging and disposal; in response to customer demand; or in response to government mandates or incentive-based policies. Whatever the motivation, INFORM has found that using reusable shipping containers can help manufacturers and agricultural producers improve their bottom lines while lessening the nation's garbage burden.

Notes

1. Some of the trade journals INFORM reviewed are: *Transportation and Distribution; Modern Materials Engineering; Modern Materials Handling; Packaging Magazine; Packaging Digest; Plastics News; Beverage Industry; Beverage World; Resource Recycling.*
2. Switching to reusable shipping containers may not lead to immediate savings in these areas. This is discussed in greater detail later in this report.
3. In New York City, resistance from a baking company's trucking union has prevented the bakery from implementing a deposit system for tracking and controlling containers that are not returned immediately to the production facility. Letter from John Okun, director, Waste Reduction and Recycling, Long Island City Business Development Corporation, June 21, 1994.
4. *The Cost to Recycle at a Materials Recovery Facility,* National Solid Waste Management Association, Washington, DC, October 1992.
5. 1972 figures: Franklin Associates, *Analysis of Trends in Municipal Solid Waste Generation, 1972 to 1987: Final Report,* prepared for Procter&Gamble, Browning Ferris Industries, General Mills, and Sears, January 1992; 1993 figures: Fibre Box Association, 1993 Annual Report, and Steve Apotheker "OCC Shines in All-Star Recycling Role," *Resource Recycling,* February 1994.
6. *International Design Guidelines for IBM Packaging Engineers,* International Business Machines Corporation, Research Triangle Park, NC, 1990.
7. This report does not explore alternatives to single-use pallets, which comprise a significant portion of the waste stream.
8. 250 is a reasonable expectation, according to the manufacturers of some reusable shipping containers.
9. The hypothetical examples in Table 1 do not take into account the huge range of box types, sizes, and shipping requirements of containers in general use. Nor do they take into account the "cradle-to-grave" environmental effects of the entire life-cycle of shipping containers, including extracting raw materials, processing, and manufacturing.
10. Charles W. Ebling, *Integrated Packaging Systemsfor Transportation and Distribution,* Marcel Dekker Inc., New York, NY, 1990.
11. Walter F. Friedman and Jerome J. Kipnees, *Distribution Packaging,* Robert E. Krieger Publishing Company, Inc., Malabar, Florida, 1977.
12. It is conceivable that a single-use container could be developed that would be collapsible, nestable, and stackable, but the cost of producing such a container for a single use would likely be prohibitive.
13. Draft article by Lawrence Dronek, marketing communications manager of LEWISystems, for *Modern Materials Handling,* April 21, 1992.
14. Larry Beck, "Drug Company Prescribes Returnable Shipping Totes," *Modern Materials Handling,* February 1989, pp. 76-77.
15. Dan Milojevich, director of support services, In-N-Out Burger (Baldwin Park, California) at $eeing Green workshop on business waste prevention, sponsored by US Environmental Protection Agency and INFORM, Los Angeles, California, June 8, 1993.
16. INFORM met with Joe M. Oates, Jr., national sales manager for custom products, and Kara M. Balmer, marketing coordinator at Perstorp Xytec in Tacoma, Washington, on September 9, 1991.
17. INFORM visited Xerox's Webster, New York, facility on December 7 and 8, 1992, and met with Robert R. Vannozzi, packaging commodity team contracting specialist, and James E. Baxter, Jr., manager of technical services. INFORM also visited H.P. Neun Company, Inc. in Fairport, New York, a private manufacturer of corrugated and set-up boxes that is also a third-party contractor that distributes Xerox's reusable shipping containers to Xerox's suppliers. INFORM met with Neun's president, James E. Woods, on December 7, 1992.
18. *The Market,* New York State Department of Economic Development, Office of Recycling Market Development, December 1991, Albany, New York.
19. *Supplier Packaging Program* (training material for Xerox suppliers), Xerox Corp., Webster, New York.
20. James E. Woods, president, H.P. Neun, plant visit, Fairport, New York, December 7, 1992.
21. Other sources have indicated greater savings, but according to Baxter, those figures may include a number of indirect cost reductions that are harder to quantify. According to *Benchmark,* a quarterly publication for Xerox customers, Xerox estimated in 1991 that the new packaging program, when fully implemented, would save the company $20 million per year. *(Benchmark,* Summer 1991, p. 6, El Segundo, California.) The Corporate Environmental Solutions Project at Stanford reported in 1991 that over a five-year period, Xerox's $8 million investment to develop the program was expected to generate $80 million in savings. (Corporate Environmental Solutions Project:

Independent Study Project, Professor Robert Augsburger, faculty advisor, Stanford Graduate School of Business, Stanford, California, June 10, 1991.)

22. *The Market,* New York State Department of Economic Development, Office of Recycling Market Development, December 1991, Albany, New York.

23. **INFORM** visited Toyota USA's plant in Georgetown, Kentucky, on June 4, 1992, and met with David R. McCulloch, specialist in production logistics control. Additional information on Toyota USA came from an April 21, 1992, draft article by Lawrence Dronek of LEWISystems for *Modern Materials Handling.*

24. Dronek, *op. cit.*

25. Letter from John Okun, director, Waste Reduction and Recycling, Long Island City Business Development Corporation, June 21, 1994.

26. *Ibid.*

27. Steve Apotheker, "OCC Tomorrow and OCC Yesterday -But What About Today?' *Resource Recycling,* March 1993.

28. *Ibid.*

29. Apotheker, *Resource Recycling,* Feb. 1994, *op. cit.*

30. *Ibid.*

31. Franklin Associates, *op. cit.*

32. Stone Container, the largest producer of container board in the United States, planned to test recyclable waxed containers in 1994; Apotheker, *Resource Recycling,* Feb. 1994, *op. cit.*

33. Spencer Hoopes, president and CEO, Perstorp Xytec, cited in "Shipping Container Market's Slow Growth," Bill Bregar, *Plastics* News, August 19, 1991.

34. Interview with Mike Reilly, manager of environmental, consumer and corporate affairs, Wakefern, Elizabeth, New Jersey, October 26, 1992.

35. Interview with Stewart's Processing Corp. president William Dake, vice-president and dairy manager Gary Dake, vice-president of plant operations Richard Dunn, and public affairs director Susan Law Dake at Stewart's headquarters, Saratoga Springs, New York, December 4, 1991.

36. Interview with S.P. (Sal) Porrazzo, director of environmental affairs, Pepsi-Cola, Somers, New York, May 28, 1992.

37. Porrazzo interview (above).

38. Linda B. Smith, manager of environmental affairs, H. E. Butt Grocery Company, written communication, June 27, 1994.

39. Reilly interview (above).

40. Telephone interview, Ted Brown, environmental affairs and promotions manager, Hannaford Brothers, September 16, 1992.

41. Telephone interview, Tim Bernthal, program developer, Puget Consumers' Co-op, July 7, 1992, and *Produce Waste Reduction Project: Final Report,* Tim Bernthal, Seattle, Washington, January 7, 1993.

42. Bernthal interview (above).

43. Bernthal, *Produce Waste Reduction Project, op. cit.*

44. PCC estimated that the break-even point for the grower was three-and-a-half months. PCC's estimate assumed a $7,800 one-year loan at 12 percent interest; $1.50 to buy each waxed cardboard container; $13 to buy each reusable container, which could be used continually over a five-year period; shipments of 400 cases per week over a four-month growing season; a 3 percent rate of loss and a 3 percent rate of breakage per year. PCC also assumed that it would need a starting float of one-and-a-half times as many containers as were shipped each week. Bernthal, *Produce Waste Reduction Project, op. cit.*

45. Brown interview (above).

46. Interview with James A. Badami, president, Dom's Empty Package Supply, New Paltz, New York, October 19, 1993.

47. Bette K. Fishbein, *Germany, Garbage, and the Green Dot: Challenging the Throwaway Society,* **INFORM,** New York, NY, 1994.

48. Interview with Peter B. Zaboji, president and chief executive officer, Schoeller International Group, April 13,1994 at **INFORM'S** office in New York, NY.

49. *Transport Packaging and the Environment 1993: State Recycling Laws Update,* Raymond Communications, Riverdale, Maryland, September 1993.

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About the Author

David Saphire is a research associate in INFORM's Sustainable Products and Practices Program, where he investigates municipal, institutional, and business waste prevention initiatives. He has presented workshops and testimony on waste prevention for solid waste planners, government officials, citizens groups, and business executives.

He is co-author of INFORM's landmark report, *Burning Garbage in the US: Practice vs. State of the Art,* and is the author of *Case Reopened: Reassessing Refillable Bottles,* which analyzes the opportunities and obstacles for reducing the environmental impact of packaging by refilling beverage bottles.

Mr. Saphire received a B.A. in environmental studies from the State University of New York at Binghamton. He has been a researcher at INFORM since 1989.

Publications and Membership

Sustainable Products and Practices: Selected Publications

Case Reopened: Reassessing Refillable Bottles (David Saphire), 1994, $25.

Germany, Garbage, and the Green Dot: Challenging the Throwaway Society (Bette K. Fishbein), 1994, 216 pp., *$25.*

Making Less Garbage: A Planning Guide for Communities (Bette K. Fishbein and Caroline Gelb), 1993, 192 pp., $30.

Business Recycling Manual (copublished with Recourse Systems, Inc.), 1991, 202 pp., $42.50.

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Reducing Office Paper Waste (Robert Graff and Bette Fishbein), 1991, 28 pp., $15.

Garbage Management in Japan: Leading the Way (Allen Hershkowitz, Ph.D., and Eugene Salerni, Ph.D.), 1987, 152 pp., $5.

Chemical Hazards Prevention: Selected Publications

Stirring Up Innovation: Environmental Improvements in Paints and Adhesives (John Young, Linda Ambrose, and Lois Lobo) 1994, 128 pp., $25.

Preventing Industrial Toxic Hazards: A Guide for Communities (Marian Wise and Lauren Kenworthy), 1993, 208 pp., $25.

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Tackling Toxics in Everyday Products: A Directory of Organizations (Nancy Lilienthal, Michele Ascione, and Adam Flint), 1992, 192 pp., $19.95.

Toward a More Informed Public: Recommendations for Improving the Toxics Release Inventory (Jacqueline B. Courteau and Nancy Lilienthal), 1991, 26 pp., $10.

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Cutting Chemical Wastes: What 29 Organic Chemical Plants Are Doing to Reduce Hazardous Wastes (David J. Sarokin, Warren R. Muir, Ph.D., Catherine G. Miller, Ph.D., and Sebastian R. Sperber), 1986,548 pp., $47.50.

Energy and Air Quality

Paving the Way to Natural Gas Vehicles (James S. Cannon), 1993, 192 pp., $25.

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Of all the reports I have read on packaging over the years, I can honestly say I learned the most from this one. *Delivering* the Goods is a timely, thorough, and thoroughly readable examination of reuse potential in an often overlooked packaging category. It provides a balanced review of reusable shipping container systems, their appropriateness for certain businesses and manufacturers, and their economic benefits.

Janet Matthews
Program Director
New York State Legislative Commission on Solid Waste Management

Delivering the Goods is a comprehensive report which provides an industry perspective and a good overview of the promise and challenges of employing reusable shipping containers. Case studies and and examples from leading businesses complement the industry perspective.

Abhay Bhushan
Manager, Environmental Leadership Programs
Xerox Corporation

Reusable shipping containers have the potential to significantly reduce muncipal solid waste generation. INFORM's report provides an excellent overview of the environmental and economic benefits of reusable shipping containers and offers practical advice to companies interested in using these containers.

Edgar Miller
Director of Policy and Programs
National Recycling Coalition