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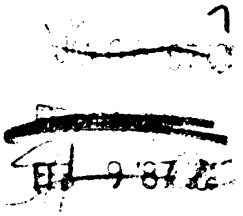

PROBLEMS IN INTERINDUSTRY COORDINATION AND SYSTEM-WIDE PRODUCTIVITY INNOVATION: AN INSTITUTIONAL ANALYSIS OF BARRIERS TO IMPLEMENTING MODULAR SHIPPING CONTAINERS FOR DRY GROCERIES

By

Charles William Abdalla

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ABSTRACT

PROBLEMS IN INTERINDUSTRY COORDINATION AND SYSTEM-WIDE PRODUCTIVITY INNOVATION: AN INSTITUTIONAL ANALYSIS OF BARRIERS TO IMPLEMENTING MODULAR SHIPPING CONTAINERS FOR DRY GROCERIES

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Viewing the chain of activities which deliver food from producer to consumer as an integrated system permits the identification of opportunities to better harmonize these activities, thus improving productivity and lowering costs. One such system-wide innovation is the modularization of shipping containers. While the potential savings of modular containers have been recognized for some time, adoption has not occurred in the U.S. dry grocery manufacturing and distribution system. A conceptual framework was constructed to analyze problems in implementing system-wide innovations. Hypotheses regarding informational and institutional barriers to coordination needed for modular package adoption were developed. Literature reviews and personal interviews were utilized to acquire data on modularization impacts and implementation barriers.

Available evidence suggested that modularization would provide substantial benefits to food distributors. Manufacturers will incur changeover costs but many will also realize productivity savings. It was concluded that one or more modular container systems could be designed that would produce net benefits and therefore have the potential to reduce food costs. Results indicated that there is considerable

agreement among manufacturers and distributors regarding critical implementation barriers. These included: the potential limitation of manufacturers' marketing flexibility; and the subjugation of distribution productivity to marketing goals in industry organizations.

Integrative analysis of the results provided insight into key barriers to modularization. The lack of awareness of problems from a system-wide perspective and different understandings of the modular packaging concept and how it would be operationalized were diagnosed as critical communication problems. Distributor procurement and cost allocation practices were found to impede intrafirm coordination and the generation of manufacturer incentives to improve shipping containers. The inability of one firm to produce benefits through modular container adoption due to the existence of a threshold limits the ability of the market to generate incentives for implementing this innovation. Given this situation, the adoption of modular shipping containers will most likely depend upon the development of institutions that create incentives for coordinated industry-wide adoption or the emergence of industry leaders that are willing to place the welfare of the overall system and the consumer above their individual interest.

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CHAPTER 1

INTRODUCTION

1.1 The Problem

In 1983, the expenditures of consumers for foods originating on farms totaled $315 billion. Of this, $230 billion, or 73 percent, paid for marketing activities. The cost of such post-harvest activities expanded at an average annual rate of 10.2 percent over the 1973 to 1983 period and played a significant part in food price increases. Over the five years prior to 1984, expanding marketing costs accounted for 84 percent of the growth in consumer food expenditures. Through the first nine months of 1984 the index of marketing costs outpaced the general inflation rate.[1]

As post-harvest activities have expanded in economic importance, greater attention has been focused on the performance of this sector. Studies have found that there are reasons to be concerned about the performance of the marketing system in general and the food distribution activities in particular. Productivity and resource utilization have been two of the performance dimensions of concern. First, productivity in transporting, wholesaling, and retailing has been stagnant and, in some cases, declining in the post 1972 period.[2] For example, labor productivity in grocery distribution centers was stagnant from 1970 to 1983.[3] A second area of concern has been the effective use of resources. Damage and losses of food occurring during distribution were estimated

to range between $1.6 and $3.2 billion (1977) on an annual basis.[4] For the dry grocery segment of the industry, losses in distribution totaled about $200 million in 1984.[5]

Greater awareness of the performance concerns mentioned above by private and public decision makers has led to a search for ways to improve the functioning of distribution activities. The standardization of shipping containers (secondary packaging) to form a modular package system has been identified as an innovation with a potential for significantly enhancing productivity and reducing food distribution costs. Despite the substantial benefits expected from modular packaging, it has not been adopted for dry grocery products in the U.S. The fundamental question addressed by this research is: Why has an innovation which offers substantial savings not been adopted by food system participants?

1.2 The Problem in Perspective

Shipping package standardization and modularization are far from new topics in the U.S. food system. As early as 1950, USDA researchers pointed out that the multiplicity of container sizes used for shipping fresh produce created waste and inefficiency and that marketing costs could be reduced through greater standardization.[6] For processed (dry grocery) products, the focus of this study, the problem of shipping container size proliferation did not receive considerable attention until the mid to late 1960s. During this time period, several food industry researchers and trade association leaders saw promise of a solution to the problem through implementation of standard modular package systems developed in Western European countries.[7,8] Finally, an emphasis on the need for productivity advances in order to control inflation, and the

application of automation to distributor's warehousing operations in the early 1970s, provided impetus for discussion of modular packaging for dry grocery products.

These events coincided with the development of a "systems approach" to improving productivity. This required greater cooperation between manufacturing and distributing segments in order to lower the total cost of delivering food to the consumer. Interindustry committees were established at the trade association level to address productivity and specific system-wide innovations. Work on the development and implementation of a standard symbol (Universal Product Code - UPC) to facilitate supermarket checkout automation served to create a mechanism for interindustry cooperation. In 1973, after UPC had been studied and the stage was set for implementation, distributor leaders attempted to use the same mechanism of joint manufacturer-distributor committees and sponsorship of research to study and advance modularization. A joint manufacturer-distributor committee guided the study which was funded solely by distributors. The study found a significant savings potential.

According to the trade press, a plan for implementation stalled because manufacturers were opposed to the change because of high costs of conversion. Through the mid to late 1970s, modular packaging receded as a topic of discussion as manufacturer-distributor relations deteriorated. This process culminated in a legal battle over cost-justified backhaul which distributors won in the U.S. Congress. Since that point, manufacturer-distributor relationships have improved and they have cooperated on several interindustry projects (e.g., uniform communications standard for computer to computer ordering, standard coupon formats and

size for handling efficiency). Their goal has been to reduce the total system cost of food distribution.

1.3 Renewed Interest in Improving Shipping Packaging

In the last decade, relatively few managers of the distribution function in wholesale and retail chain companies have been vocal about the problems of inadequate shipping packaging. Those managers have noted in particular damage and difficulties encountered in automated/mechanized warehouses, and they have continued their plea for improvements and standard sizes. The vast majority, however, have been somewhat complacent about poor secondary packaging. They often accept the packaging deficiencies and size proliferation as a fact of life, and its consequences as a cost of doing business. Discussion of the topic which did occur was limited to joint meetings of operations managers from manufacturer and distributor companies and as a whole was ineffective in bringing about results. The lack of top management involvement in these meetings has often been cited as a reason for their lack of success.

More recently, a number of changing factors have led to a resurgence of interest in improving secondary packaging. The factors of inflation, steadily increasing labor and transportation costs, concern over the cost of product damage, and the application of new technologies in the warehouse have renewed interest in addressing this topic. The improved interindustry relations at the collective level which evolved in 1980 and 1981 and led to the joint study of coupon handling efficiency and procedures for computer to computer ordering also was a major factor. At an industry relations conference held in 1982, top executives and trade leaders representing suppliers and distributors agreed to

feasibility studies in the general area of physical distribution.[9] Discussions continued and in October 1983, a Request for Proposals (RFP) for a study focusing on enhancing physical distribution efficiency through improvements in shipping container design was put out for bids from consultants. (The RFP can be found as Exhibit 1 in Appendix B.) Four proposals were reviewed in December 1983 by a joint steering committee which was co-chaired by one representative from food manufacturing and one from retailing. The consulting firm of A.T. Kearney was chosen to conduct the study and commenced work in March 1984.[10] The first phase of the study, which included a mail survey of 86 manufacturers and distributors, found 29 opportunities for savings through altering shipping containers. Of those opportunities, two design improvements, standardization of shipping containers having the same retail package size and the improving of strength of bags, were identified as major saving areas. These are proposed for in-depth analysis in the second part of the study which will develop generic guidelines for implementation. The last phase of the study will focus on planning the implementation process for each feasible design improvement by obtaining the needed industry concensus.[11] Completion of the study is expected by mid 1985.[12]

1.4 Previous Treatment of the Topic

Modularization of dry grocery shipping containers is a relatively unstudied topic in the U.S. Outside this country, several nations of Western Europe have probed the tropic and have actually implemented modular packaging programs. For instance, Sweden and Switzerland developed modular packaging systems in the mid 1960s.[13] In 1983, the

potential benefits of modularization were investigated in the Netherlands and the documented savings led to the development of voluntary standard modular sizes.[14]

The limited investigation which has been conducted in the U.S. has been of four primary types. First, studies have been undertaken which have identified the extent of the size proliferation problem.[15,16] Second, surveys of a wide spectrum of industry participants have identified the standardization and modularization of packaging to be a significant opportunity to improve physical distribution efficiency and potentially lower food costs.[17,18,19] Third, empirical investigation of the potential savings due to implementing a modular system has been undertaken in only one study by A.D. Little in 1974 and it focused only on distributor level effects. Finally, several studies have identified and analyzed barriers to implementation.[20,21] In sum, while package standardization has been an often discussed topic in food industry circles, few research resources have been committed to its study. Consequently, a relatively small base of existing knowledge now exists.

1.5 Research Objectives

The primary motivating force for undertaking this study was to improve food system performance. Performance is a multi-dimensional concept. An important performance dimension is the technical efficiency of resource use in the food distribution system. A basic premise underlying this research is that adoption of modular secondary packaging would improve the efficiency of resource use and thus lower costs of delivering food to consumers. Available evidence from modular programs implemented in Western Europe and from the limited research performed in the U.S. indicates that modularization would produce significant savings

in distributors' physical distribution operations. This could possibly result in savings within manufacturing firms. In order to know if modularization would lower marketing costs, information is needed on the costs of conversion which fall primarily on the manufacturer. Unfortunately, no estimates of this cost have been made. This study postulates that there is some, or more than one, system(s) of modular package sizes for which total benefits can be achieved. One reason for expecting this research postulate to be accurate is that conversion costs would decrease for modular package systems which have: 1) a greater number of sizes; and 2) a longer implementation period. Acceptance of this postulate leads to a second question: Given that modular package systems exist with the potential to lower total food distribution costs, why don't food system participants act to implement them?

The preceding question provides the focus for study in this research effort. The primary thesis is that improved performance of the food system is constrained by the failure of existing institutions to adjust to newly available technological possibilities (e.g., modular packaging). Thus, fundamental objectives of this research are: 1) to identify and analyze institutional barriers to modularization; and 2) to identify and contribute to the design of institutional innovations which facilitate implementation. The objectives are specified more completely below.

- To summarize and evaluate the existing empirical work on the benefits and costs of conversion to a modular system of food shipping containers.
- Increase understanding of modular container system implementation by identifying and describing key participants, their

attitudes and behavioral practices; environmental forces and processes; and organizational features and institutional structures of the U.S. food system.

- Identify, describe, and analyze the critical organizational and institutional factors which act as barriers or present opportunities to improve grocery distribution system performance through modularization.
- Develop, refine, and test the validity of hypotheses about the organizational and institutional factors influencing modular container implementation.
- Contribute to the design of institutions which enhance food system performance through modularization and assess their policy implications.

1.6 Organization of the Dissertation

Following this introduction are eight chapters. Chapter 2 presents the author's attempt to construct a framework for the analysis of system-wide innovation. The methods used to acquire data are described in Chapter 3. In Chapter 4, the nature of the shipping container size proliferation problem is explained, the modular packaging concept defined, and the history and current status of modularization outlined. Chapter 5 delineates the probable effects of implementing a modular packaging system and reviews available empirical evidence on these impacts. The findings of the research are presented in Chapters 6 and 7. Informational barriers to modular packaging are identified and explained in Chapter 6. In Chapter 7, the institutional barriers identified in the literature review and interviews are presented. Chapter 8 attempts to analyze the research findings in an integrative manner, identify

forces creating opportunities for implementation, and design several institutional innovations. The study's conclusions, policy implications, and suggestions for further research can be found in Chapter 9.

CHAPTER 1

FOOTNOTES

[1]U.S. Department of Agriculture, Agricultural Outlook, Washington, D.C. (November 1984), p. 16.

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CHAPTER 2

TOWARD A FRAMEWORK FOR THE ANALYSIS OF SYSTEM-WIDE INNOVATION

This chapter presents the analytical framework constructed for use in this study. An attempt is made to develop a framework broad enough to encompass both the vertical and horizontal dimensions of the process of system-wide innovation. The principle components of the framework are first introduced. A vertical and horizontal "systems" perspective is explained and taxonomy of "systems" innovations is developed. Modular packaging is then conceptualized as a problem of exchange between manufacturers and distributors. Theoretical concepts for analyzing this exchange relationship are assembled. They include: 1) a set of concepts from vertical coordination and organizational theory for analyzing vertical interindustry relationships; 2) a set of concepts relevant for studying horizontal industry-wide relationships.

2.1 The Analytical Framework: Principle Components

This section introduces the framework constructed for the analysis of system-wide change. Since no generally accepted theoretical framework for the analysis of system-wide innovation processes exists, the remaining sections of this chapter can be viewed as an initial step toward the development of such a framework.

The conceptual framework is eclectic. It draws together a set of theoretical concepts for: 1) diagnosing problems of system-wide

innovation; 2) suggesting important variables; and 3) developing hypotheses about relationships among variables for empirical study. The framework is presented in three steps. In this section, the "systems" orientation of the research approach and a taxonomy of system-wide innovations are explained. A conceptual model which frames the adoption of system-wide innovations as a problem of exchange is developed in Section 2.2. As the model is complicated by relaxing some initial simplifying assumptions in Sections 2.3 and 2.4, it suggests that the adoption of system-wide innovations depend upon the effectiveness of existing institutional mechanisms: 1) to coordinate activities of participants vertically between adjacent industry stages; and 2) to coordinate activities horizontally among firms at an industry level. Thus, a set of theoretical concepts for analyzing vertical and horizontal coordination are presented in Sections 2.5 and 2.6, respectively.

2.1.1 A Systems Perspective

A "systems" approach advances a simple notion: activities should be viewed in the context of the broader system in which they exist. Such an approach is useful in two ways. First, it emphasizes the interconnectedness of activities. One participant's decisions have ramifications for other participants and for the performance of the total system. A fundamental problem that arises is that independent "micro-level" decisions produce external effects that lead to overall or "macro" results which are suboptimal when the system is viewed as a totality. Second, the broader management perspective of the approach permits the identification of opportunities for rationalizing individual activities to improve performance of the total system. In other terms, the approach suggests ways in which individual ("micro") decisions

might be changed to lead to improved "macro" or system-wide performance. The "systems approach" can be applied in both a vertical and horizontal sense to the analysis of food marketing system performance.

A. A Vertical Systems Perspective

A vertical systems orientation emphasizes the performance of the total sequence of activities involved in producing and marketing food. Thus, system performance depends not only on the performance of an individual stage, but also upon the coordination of activity among the many vertically-aligned stages. As the vertical production-distribution system has been transformed through industrialization into a more complex sequence of specialized activities, the importance and difficulty of coordination has increased.[1] The general vertical systems orientation just described is applied to the dry grocery manufacturing and distribution system below.

A simplified model of the marketing channel for grocery products consisting of three participants (manufacturers, distributors, and consumers) is depicted in Figure 2.1. From a vertical systems perspective, the emphasis is placed upon performance of the total system, not the performance of one industry level. A fundamental reason for this is that it is possible for one industry stage to take actions to lower its costs and for changes to be made at an adjacent stage which lower its costs; but because the actions are not coordinated, the end result can be higher system costs and consumer prices. Thus, independent micro-level decisions do not yield desirable macro (in a vertical sense) results (e.g., higher food prices and thus potentially lower sales). For example, a manufacturer might change its shipping packaging to save

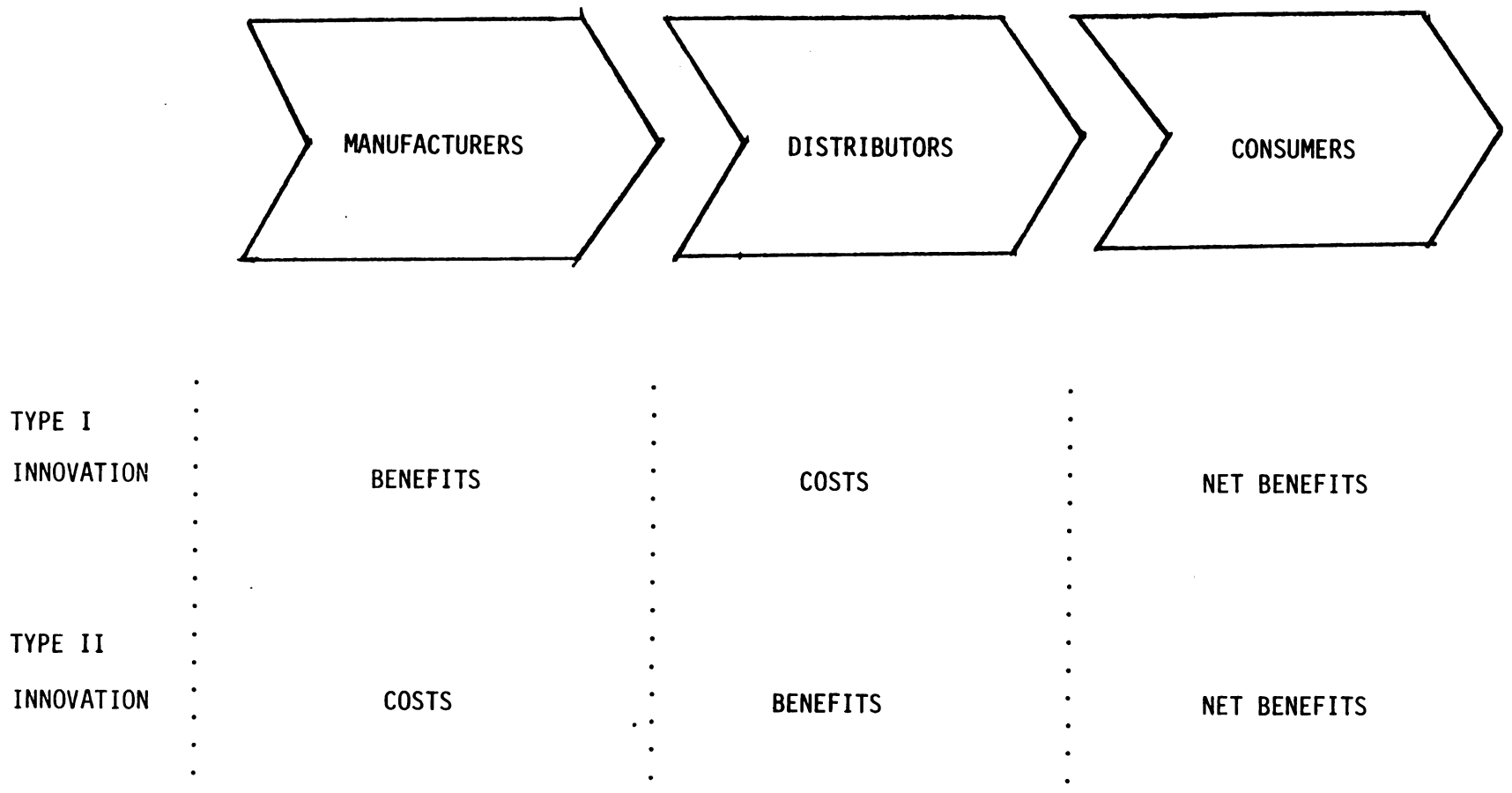


Figure 2.1 A Simplified Model of System-Wide Innovation

material costs. However, the change may actually increase handling costs for a distributor. If these increased costs outweigh the manufacturer's cost savings, the end result will be higher prices to consumers. On the other hand, there are potential changes which involve higher costs for one stage, but create savings for another which exceed these costs. Therefore, total system costs would be lower even though costs for one stage have increased. Both stages in the vertical channel would benefit to the extent to which the savings were passed on to the consumer and the reduced prices resulted in expanded sales. A system-wide innovation of this type, the Universal Product Code (UPC) symbol, is briefly discussed below.

Interest among food industry participants in a vertical "systems approach" has expanded. For over a decade, industry researchers and leaders have recognized that the performance of the food marketing system depends not only upon the efficiency of the individual parts of the food marketing chain, but also on the way in which the individual parts are put together to make an efficient, total system.[2] Many believe that most of the productivity improvements within firms at individual stages have been taken advantage of and that the significant opportunities for productivity growth for the industry as a whole lie in improved coordination between firm's performing activities at consecutive steps in the system.[3,4,5]

Application of the systems approach to improving performance of the food marketing system is often intertwined with the process of technological change. Through scientific industrialization, new technological opportunities are created for improving productivity. For these innovations to be exploited, cooperation between previously

uncoordinated and diverse interest groups is needed. Future advances in total system efficiency depend to a large part on the food industry's ability to gain the necessary cooperation across traditional firm boundaries. Thus, an important and difficult task is to devise ways for participants with diverse interests to coordinate their actions to implement innovations which can lower total system costs.[6] A classic example of such interindustry cooperation was the implementation of the UPC symbol. In order for retailers to increase productivity and reduce their costs through scanning at the supermarket checkout, manufacturers had to incur the cost of applying UPC symbols on their retail packages. A focus on total system costs, as opposed to effects at one industry stage, provided impetus for implementation of UPC. The UPC is generally cited as evidence of the benefits of an interindustry (i.e., vertical) systems approach. The joint industry efforts to implement UPC also established a model mechanism for studying and implementing system-wide innovations.

B. A Horizontal Systems Perspective

The systems approach is also relevant at a horizontal or industry level. Emphasis is placed upon performance of the overall industry rather than any one individual firm. Such a perspective would advocate individual firm (micro-level) decision making which takes into account effects upon macro or industry-level performance. If all firms make decisions this way, the position of the industry will be maximized. Conversely, if firms pursue their individual interest without taking into account macro-level consequences, the industry's welfare will be reduced.

While the systems approach suggests an overall strategy to advance the position of an industry, individual decision making is constrained by competitive forces. The effect of different market structures upon firm decisions has been extensively studied in industrial organization. This subfield of economics has studied firms' abilities to achieve increased product prices. However, many of the principles involved in analyzing firms' abilities to collectively increase prices are applicable to firms' abilities to attain the benefits of industry-wide innovations which lower their costs.

In a perfectly competitive market, no one firm is large enough to affect price and, thus, each takes the market price as given. Individuals make their decisions with the expectation that it will not affect prices which all firms in the industry receive. The focus is upon the individual costs and returns associated with an action. The cumulative result of individual decisions can lead to results which are undesirable for the industry as a whole. For example, a farmer may increase his/her returns by putting more land into production. If all farmers follow this strategy, the cumulative result will be expanded product supply and, assuming constant demand conditions, lower prices. Industry revenues and profits will decline. Thus, in competitive markets, the focus upon individual gains to the exclusion of broader market-generated effects reduces the welfare of all firms in the industry. The market acts as a force preventing coordinated firm actions with a systems perspective to collectively enhance their position. The ability of the market to do this is viewed positively in that competition drives prices lower. However, individual oriented decision making in a competitive setting can prevent firms from adopting a macro view which allows them

to coordinate their actions to implement industry-wide innovations offering savings to all firms.

At the opposite end of the market structure, continuum is monopoly. A monopolist would employ a broader horizontal perspective. It would also have the capability to implement industry-wide changes. The area of most concern is in-between the extremes of perfect competition and monopoly. In general, the fewer firms in a market, the greater the awareness of the interdependence between individual firm actions. Thus, decisions may be made with a consideration of impacts on other firms, these firms' probable reactions, and ultimately the effect upon the welfare of the industry as a whole. For example, in a small numbers oligopoly situation, each firm may preclude lowering price since it anticipates that others will follow suit. Thus, firms may collude, tacitly or not, to achieve collective goals. The most frequently discussed shared goal is that of higher prices. However, it is conceivable that firms could collude to achieve other shared goals such as the implementation of industry innovations which reduce costs.

2.1.2 A Taxonomy of System-Wide Innovations

This section presents a taxonomy of system-wide innovations. These innovations are changes which require interaction and cooperation between two or more vertically-aligned industry stages for their implementation. Figure 2.1 provides a general interindustry model of system-wide innovation. Two assumptions are made regarding this model. First, the benefits of the innovation exceed its costs, thereby reducing total system costs. Second, competition at both the manufacturing and distribution stage is sufficient for at least some of the net savings from the innovation to be passed on to the next vertical stage and, ultimately, to

consumers. If the goods in question are normal, consumers can be expected to purchase more of them, thereby increasing industry sales. The impact on revenues would depend upon the product's price elasticity of demand. Consequently, even if most or all of the savings are passed on to consumers, system-wide innovations could produce a benefit to the vertical system as a whole. A taxonomy is developed below which classifies these types of innovations by their vertical and horizontal characteristics.

A. A Vertical Classification

System-wide innovations can be classified on the basis of the incidence of benefits and costs among the vertical stages of the marketing channel. Suppose an innovation is devised capable of improving productivity at one stage, but its implementation requires action to be undertaken and costs to be incurred at another. The focus here is upon the net effect (e.g., net benefits or net costs) of the innovation for each stage. An innovation might have benefits for a particular stage, but if the costs of change exceed these benefits, the overall effect is a net cost. Two alternative situations where net costs and net benefits of an innovation are distributed unevenly between the vertical stages of the marketing channel are illustrated in Figure 2.1 and described below.

A Type I innovation provides benefits to manufacturers and costs to distributors. Manufacturers enjoyment of benefits from the innovation depend upon distributors' willingness to incur the costs of making changes necessary for implementation. An example of a Type I innovation is the use of slipsheets as a unitizing device for loads of manufacturers' products. These disposable corrugated sheets are substitutes for pallets and can lower manufacturers' costs by increasing space utilization in

warehousing and transportation and reducing pallet loss. However, their use by manufacturers requires that distributors have specialized truck unloading equipment. Thus, the benefits to manufacturers depend upon an investment by distributors.

Type II system-wide innovations are illustrated in the bottom of Figure 2.1. For these innovations, benefits accrue to distributors while the costs of implementing them are borne by manufacturers. Examples of Type II innovations include the backhaul of products from manufacturer warehouses by distributor trucks returning from retail store deliveries, standard bar codes on retail packages (UPC) and shipping containers, and modular secondary packaging.

B. A Horizontal Classification

Systems innovations can be further classified into simple interindustry and industry-wide changes. The distinction hinges on how the benefit of the change is supplied. For a simple interindustry innovation, one firm at an industry level can supply a benefit to one or more firms at an adjacent vertical stage. A Type I example is slipsheets. One distributor which invests in slipsheet handling equipment can produce benefits for one or more suppliers. A Type II example is backhaul. A single supplier which permits one or more distributors to pick up merchandise at its dock can provide benefits to them.

The benefits of industry-wide innovations for one stage cannot be produced by the action of one firm in the adjacent vertical stage. Rather, coordinated action by some critical proportion of firms at one industry level is needed to yield benefits for the other adjacent stage. An example of Type II industry-wide innovation is the UPC symbol. A single manufacturer which sourcemarked its retail packages with the

symbol was useless to a distributor. Not until a large percentage of manufacturers' retail packages had the symbol in place could distributors realize savings through scanning at the supermarket checkout.

2.2 A Conceptual Model for Analyzing Modular Package Adoption

It this section, a simple conceptual model of the process of implementing modular shipping containers is developed. Modularization is initially conceptualized as a problem of exchange between two parties, manufacturers and distributors. A number of factors are hypothesized which could potentially affect this exchange. The model is then complicated by relaxing some of the limiting simplistic assumptions.

2.2.1 Modularization as a Problem of Exchange

It is assumed that some modular packaging system exists for which total benefits exceed total costs. Modularization is taken to be a Type II system-wide innovation. Some benefits will accrue to manufacturers through internal standardization resulting from modularization. However, since these manufacturers have not presently acted to achieve the savings from internal standardization, it can be inferred that modularization probably involves net costs for manufacturers. The majority of the savings from modular packaging will accrue to distributors. This distribution of benefits and costs indicates that modularization is a Type II innovation.

Modularization is framed as a problem of exchange between manufacturers and distributors. Manufacturers, who currently hold the right to determine shipping container size and would incur costs to modularize their packages, can be visualized as sellers of modular packaging. Distributors can be viewed as potential bidders for those rights in their

requests for modular containers. If the benefits to distributors are greater than the costs to manufacturers, one would expect a trade to occur and modularization to be implemented. However, a number of factors can act as impediments to an exchange. In the simple model below, several categories of factors which affect the exchange process are identified. The next section examines several more complex variations of the model.

The initial model assumes that manufacturing and distributing sectors are each composed of a single homogeneous entity. The exchange relationship is that of bilateral monopoly. Also, it is assumed that participants have perfect knowledge and that transaction costs are zero. The distributor demand for standardization of containers is a function of: 1) the price of substitute ways to improving distributor productivity; 2) the price of complementary goods to modularization (e.g., automated warehouse technology); and 3) the income level (i.e., profit level) of distributors. Manufacturers' willingness to supply modular containers is hypothesized to be a function of the price of inputs (e.g., new equipment or package materials) and the flexibility of existing technology. Given that the benefits to distributors are greater than suppliers' conversion costs for a particular modular package system, one would expect an exchange to occur.

In reality, participants are not omniscient and positive transaction costs exist. There are important implications for exchange. If distributors are unaware of modular packaging benefits or uncertain of their magnitude, they are likely not to make a bid or will make a very low bid to manufacturers. Similarly, manufacturers will be less likely to supply modular packages if they are uncertain what costs it will

entail. In general, to the extent participants lack knowledge of modularization or are uncertain of its effects, the exchange needed for implementation is less likely to occur.

Positive transaction costs are a second factor affecting exchange. Property rights determine who must make a bid to whom and, thus, what party bears the transaction costs of an exchange. In the case of modularization, the rights to determine package sizes are currently with the manufacturer. Thus, a distributor must bear the costs of making a transaction with manufacturers to implement modularization. The magnitude of transaction costs affects the amount of the bid. If these costs exceed the perceived benefit of the exchange, then a bid will not be forthcoming. In other terms, the actual bid will be the net of transaction costs.

2.2.2 Expanding the Model Horizontally

The simple model developed above characterizes modularization as a problem of exchange between two homogeneous parties. In order to be useful for analysis, the model requires expansion horizontally to account for the fact that there are many heterogeneous firms in each participant category. In this section, the model is complicated in three steps. First, the distributing sector is expanded to a multi-firm entity. Second, the manufacturing sector is expanded to a multi-firm entity transacting with a single entity distributor sector. Finally, a horizontally expanded multi-firm distributing and manufacturing sector are considered together.

A. A Multi-Firm Distributor Sector

In this version of the model, the exchange needed for modularization must occur between one manufacturer and numerous distributors. From a manufacturer's standpoint, there is little problem in supplying modular containers as long as the distributors have identical preferences for specific modular sizes. One firm makes all products and, thus, can modularize enough of them to produce savings for distributors. However, if distributors are heterogeneous and have different preferences for modular packages, the manufacturer would have difficulty meeting these diverse needs. Thus, distributor heterogeneity decreases the likelihood of an exchange.

The bid process is made much more difficult for a multi-firm distributing sector. First consider the case of homogeneous distributor preferences. Compared to the bilateral monopoly relationship discussed in Section 2.2.1, distributors have a relatively weaker bargaining position. One distributor's bid may be insufficient for a manufacturer to incur the cost of changing equipment to produce modular sizes. Thus, distributors need to collectively bid to the manufacturer. The cost of organizing a collective bid is an additional transaction cost burden that distributors face in attempting to make an exchange with manufacturers. If distributors are heterogeneous, the cost of agreeing on a uniform demand increases the transaction costs. If the total transaction costs including the costs of collective decision making are greater than the perceived benefit of modularization, a bid will not be made.

B. A Multi-Firm Manufacturing Sector

The manufacturing sector is now assumed to be made up of many firms that transact with a single distributor. In this case, one manufacturer

only produces a fraction of all products and it cannot, by its action alone, change enough products to yield benefits to the distributor. For an industry-wide innovation, manufacturers must collectively change their packaging to supply modularization benefits. These collective efforts involve transaction costs. In a heterogeneous manufacturing sector, transaction costs of joint decision making are much greater. This further diminishes manufacturers' abilities to offer a uniform modular system of packaging. In markets with many firms, competitive forces run counter to cooperative efforts to offer modular packaging. Some mechanism is needed to horizontally coordinate the independent decisions of manufacturers in order to supply a uniform system of modular sizes.

The distributor facing a multi-firm manufacturing sector should have increased bargaining leverage. However, compared to the initial two-party model, the transaction costs of making a bid are increased since it must deal with many manufacturers rather than one. These transaction costs reduce the bid distributors will make and the likelihood that an exchange will occur.

C. A Two-Party Multi-Firm Model

This most complex and realistic form of the model is presented in this section. The manufacturing and distributing sectors are both considered to be made up of many firms. The general implications of such a two-party multi-firm model are discussed. Also, the relevance of the first two simpler models for analysis of manufacturer-distributor exchange relations are pointed out.

The exchange relationship between many manufacturers and distributors is more complex than the exchange relationship described in the

simpler models. The barriers to exchange are a summation of the transaction costs identified in each model. Distributors must overcome the burden of three layers of transaction costs to implement modularization. First, since property rights are held by suppliers, distributors must initiate the bid to suppliers. Second, distributors have to incur the cost of organizing themselves to make a collective bid for a uniform modular system. Third, once collectively organized, distributors must seek out a critical proportion of manufacturers to place the bid since industry-wide adoption is necessary to yield benefits. If these total transaction costs are greater than the perceived benefits of modularization, the exchange between manufacturers and distributors will not occur.

The simple models described in Sections A and B can be used to approximate some real world exchange situations. For example, some aspects of the single manufacturer multi-firm distributing sector model are relevant for unequal bargaining power relationships between distributors and national manufacturers with established brand franchises (i.e., there is none or few substitutes for their food product). Conversely, the single distributor multi-firm manufacturing model represents the bargaining relationship between large distributors and smaller regional manufacturers without strong brand franchises or producers of private label and generic products.

Comparing the single and multi-firm manufacturers' model illustrates the different problems in implementation of a simple interindustry and industry-wide systems innovations. In a single manufacturer model, the manufacturer can produce either type of innovation. Since it has control over all products, it can accomplish the critical amount of change needed to produce benefits from industry-wide innovations such as

modularization. However, in the case of the multi-firm manufacturer model, a single manufacturer can only implement simple interindustry innovations. For industry-wide innovations, such as modularization, one manufacturer's actions are insufficient and some horizontal co-ordinating mechanism is needed for implementation by enough firms to produce savings to distributors.

2.2.3 Expanding the Model Vertically

The conceptual model developed in Section 2.2.2 is narrow in its consideration of the vertical dimension. It focuses on only one segment, the manufacturer-distributor interface, of the vertical food marketing channel. In this section, the model is vertically expanded in two ways. First, it is expanded so that the manufacturer-distributor exchange is seen as part of the larger vertical system. The driving force in the system is consumers who express preferences for products through transactions with distributors. Since consumers are interested in increasing their real wealth, they have a preference for low prices and, thus, indirectly for innovations such as modularization which could lower food distribution costs. Thus, modular package adoption can be viewed as a sequence of exchanges between vertically-aligned firms. The entire sequence must be coordinated in order for consumers' preferences for low-cost products to be articulated and for manufacturers to respond with products having characteristics which facilitate efficient distribution.

The introduction of additional vertical stages can change the nature of the manufacturer-distributor exchange. In the simple model above, modular package adoption depended upon distributors compensating manufacturers for the cost of the change. Manufacturers only benefited

to the extent the compensation was greater than the costs incurred. However, in a vertically expanded model, manufacturers have a different type of reward for making changes which reduce costs for distributors. This is the reward of increased consumer sales. If competition at the distributor level is sufficient so that savings from the innovation are passed along as lower prices, sales of a manufacturer(s') product would increase. This benefit is quite different for the categories of simple and industry-wide interindustry innovations. For simple interindustry innovations, one manufacturer can implement change and, thus, produce savings to a distributor which, in turn, can be passed to consumers. Increased consumer purchases of the cheaper product would be expected, thereby benefitting the manufacturer by increasing its market share. However, the reward to a manufacturer from implementing and industry-wide systems innovation is much different. Since many manufacturers must implement the change to produce cost savings to distributors, the products of all manufacturers who change will be reduced in price. Thus, the reward is diffused among the group. If this group makes up only part of the industry, this segment would increase its share relative to the rest. If the group includes the entire industry, then relative market shares of individual firms would remain the same. However, food manufacturers as a whole would benefit to the extent that consumers increase their food purchases relative to other items or if they increase their consumption of food sold through supermarket outlets.

A final note should be made regarding the effect of competition on distributors' demand. In the previous section, it was argued that distributors would make a bid for modular packages if they perceived benefits were greater than the cost of transacting with manufacturers.

While competition can provide a reward to manufacturers by forcing distributor savings to be translated into lower product prices, it can also serve to reduce the benefit to distributors of implementing modularization. For example, if a distributor believes that the cost savings from modularization may be short-lived because competition will force them to be passed to consumers, the perceived benefit and, thus, the incentive to make a bid for modularization will be reduced. However, some incentive for a distributor to bid for modular containers should exist since the first adopters should enjoy cost savings before modular containers are used by most firms. The general effect of increased competition is to reduce the magnitude of the savings and the incentive to make a bid. If a distributor believes that short-run savings will be large enough to gain a competitive advantage, or that it has sufficient market power to retain at least some of the cost savings in the long term, then it will have an incentive to bid for modular containers.

A second way in which the model requires vertical expansion is to account for the fact that numerous transactions occur in a vertical fashion through the manufacturing and distributing sector. These transactions are both bargained (market) or administrative (intrafirm) and occur between organizations and firms, departments, and individuals. As the number of transactions increase, the potential for ineffective transmittal of information about preferences and economic incentives become greater. Thus, exchange at the manufacturer-distributor interface necessary for modular package implementation depends upon the ability of the entire sequence of transactions in the vertical channel to convey accurate economic signals. Section 2.7 briefly overviews vertical

coordination theory and describes some key concepts for analyzing the vertical coordination process.

2.3 Some Additional Research Assumptions

Several of the theoretical assumptions frequently attributed to neoclassical economics do not appear to hold in this problem setting. Thus, it is necessary to supplement the neoclassical model with some assumptions about environmental conditions and behavior. First, participants exist in an environment of uncertainty. Second, information is costly. Third, individuals are limited in their cognitive abilities: 1) to discover, process, and store all of the information which is relevant to a decision; and 2) to deal with complexity and uncertainty of the environment. Consequently, individuals exhibit bounded rationality or behavior which is "intendedly rational, but only limitedly so."[7] Fourth, externalities are pervasive and many goods exhibit the "public good" characteristic of non-exclusiveness.

2.4 A Classification of Concepts for Analyzing Vertical Coordination

At the most fundamental level, this section and the next deal with preference articulation, or "the processes by which individuals' preferences are expressed and taken into account."[8] The process is executed through market, political, and social transactions which carry information, influence, and incentives. The ability of the food system to effectively facilitate the articulation of preferences is a critical performance consideration.

In Sections 2.5 and 2.6, an attempt is made to develop a set of analytical concepts for the diagnosis of problems in the preference

articulation process and to suggest ways to improve the process. These sections focus on a special problem of preference articulation: the vertical coordination of supply with demand. It deals with "the sufficiency of price as a carrier of information and the behavior of participants in strategic positions."[9] Marion defines vertical coordination as the "process by which the various functions of a vertical value-adding system are brought into harmony."[10] The definition has two levels of focus. First, it refers to the synchronization or fine-tuning of an existing vertical sequence of activities so that products are produced and marketed in the desired form, time, and place. Improving coordination in this sense involves routinizing and stabilizing participant activities and relationships. It results in a streamlined system that is relevant in the short- and intermediate-run. Vertical coordination is most frequently interpreted from this synchronizing standpoint. A second level of focus is on the ability of a system to adjust to change and new opportunities (e.g., demand or technology). Coordination in this adaptation sense involves very different forces than synchronization since it may involve revamping a current system to improve it for superior performance in the long-run.[11]

The above distinction is used to structure the discussion in the remainder of this chapter. Analytic concepts for studying vertical coordination in a synchronizing sense are presented in Section 2.7. In essence, this section focuses on the problems of synchronizing micro decisions and macro results in a vertical systems context. It is argued that many simple interindustry innovations (e.g., backhaul) could be effectively analyzed within this framework. A framework consisting of concepts for analyzing vertical adaptation is presented in Section 2.8.

It is argued that this expanded framework is necessary to analyze the horizontal aspects of industry-wide systems innovations. The framework is expanded horizontally since it examines the connections between firm decisions (micro) and collective industry (macro) decisions as they relate to implementing system-wide change.

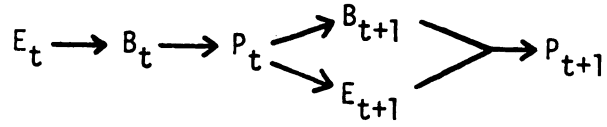
2.5 Concepts for the Analysis of Vertical Coordination

Vertical coordination research has its roots in the structure-conduct-performance (S-C-P) paradigm of industrial organization economics. The original S-C-P framework had a horizontal orientation and postulated the market structure influenced the conduct of firms that, in turn, yielded certain performance outcomes. McLaughlin[12] provides an in-depth description of the evolution of the S-C-P paradigm as it has been expanded to include vertical relationships and dynamic elements. The conceptual framework adopted for this study is most akin to the institutional coordination-adaptation approach described in Marion's[13] taxonomy of approaches to vertical coordination and further developed by Shaffer.[14]

In its broadest form, the conceptual framework has been expressed as an evolving three-term sequence of environment-behavior-performance (E-B-P). The environmental situation defines the opportunity set. The physical environment determines the limits of technically feasible opportunities and payoffs for society. The opportunity set is further limited by institutions which consist of rules governing access to the aggregate payoff matrix. The institutional structure includes the organizations in which individuals operate. Thus, individual's opportunities are defined not just by the environment which is external to the firm, but also by an organization's internal structure.[15]

Investigation of an organization's internal structural features and rules can provide insight into individual behavior and, therefore, the aggregate behavior of the organization.

The dynamics of the E-B-P framework are illustrated in the following diagram:



Performance in period t is a function of participants' behavioral responses within their existing opportunity sets. The aggregate outcome represents a change in the environment (E_{t+1}) and thus in the opportunity set and incentives (expected benefits and costs) which guide behavior (B_{t+1}). In addition, the participants themselves change their perceptions and preferences.[16] Thus, attention must be paid to the feedback effects in order to understand the function of a dynamic evolving system.

A final note about this paradigm is the broader notion of performance. Early applications of the S-C-P paradigm considered relatively few performance dimensions, often focusing on technical efficiency, equity, and progressiveness. However, a number of researchers began to expand the list of performance criteria. Sosnick outlined 12 dimensions of performance which included unethical practices, participant rationality, conservation, and externalities.[17] Hildreth, Krause, and Nelson added income and power distribution to the list of performance dimensions.[18] Jesse summarized work on the conceptualization and measurement of performance and developed an approach for identifying specific performance measures. He bagan by accepting a performance "bill of rights" set forth by Shaffer which identified broad normative

performance objectives.[19] A method was devised which used performance indicators implied by the broad performance objectives as benchmarks against which performance extremes could be measured in a relative sense. A broad array of performance indicators were incorporated.

Shaffer further expands the breadth of performance criteria considered.[20] He argues that individuals have preferences for the manner in which the food system is instituted. For example, are the rules of the economic game considered fair? Also, people have preferences for freedom. Preferences for performance dimensions of this type must be, for the most part, articulated through the political system.

Several of the performance criteria mentioned are of particular concern for this study. They are: 1) technical efficiency; 2) progressiveness; 3) resource conservation; 4) third party effects; 5) fairness; and 6) freedom.

2.5.1 Vertical Coordination Defined

Mighell and Jones defined vertical coordination as "the general term that includes all the ways of harmonizing the vertical stages of production and marketing."[21] While the definition is simple and intuitive, several interpretations of the concept have been made, perhaps because of the complexity of vertical coordination. First, vertical coordination is sometimes used to refer to exchange arrangements. More properly, these institutional arrangements should be viewed as alternative mechanisms for achieving vertical coordination.[22] Examples, just to name a few, are markets, contracts vertical integration, cooperatives, grades and standards, and trade associations.[23]

Clarification of vertical coordination is required at a second level. Vertical coordination has been defined as an objective and as a

process. Marion and many other agricultural economists favor an interpretation of vertical coordination as a process. Thus, coordinating mechanisms influence the process of coordination and some mechanisms may result in improved coordination. Lang does a thorough job of defining and distinguishing between vertical coordination as an objective and as a process, and arrived at the following somewhat integrative definition:

> Vertical coordination as an objective of vertical coordination as a process is to maximize the level of vertical coordination achieved for a given level of transaction costs.[24]

Lang also observes that: 1) there are obstacles to achieving vertical coordination; 2) removal of these obstacles is a costly process; and 3) the purpose of different vertical coordination mechanisms is to carry out this process. Thus, a key research question is whether some coordination methods move the marketing system closer to the theoretical ideal of perfect coordination than others for a given level of costs.

2.5.2 Intrafirm Decision Making: The Role of Standard Operating Procedures

Neoclassical economic theory has treated the firm as a black box, or more aptly, "as a production function to which the profit maximization has been ascribed."[25] In the discussion of the E-B-P framework in Section 2.4.1, it was suggested that individual behavior was a function of the internal structure of the organization in which he/she belonged. This section borrows several analytical concepts from organizational theory in order to develop a richer understanding of individual and firm behavior. The aim of the section is twofold. First, it attempts to provide a link between individual intrafirm decision making and vertical coordination. A second purpose is to provide a focus for empirical study of internal firm decision making.

A. Firms' Decision Making

Several organizational theorists have provided insight into firms' decision processes. Simon[26] emphasized that the cognitive limits of individuals as they attempt to solve problems in a complex uncertain environment lead to behavior which is rational in a bounded sense. He argues that bounded rationality is the primary reason for organizational problems and why there is a need for the study of organizations. One implication of bounded rationality is that decision makers make satisfactory choices rather than optimal ones.

Cyert and March,[27] working along lines similar to Simon, wrote A Behavioral Theory of the Firm. The basic thrust of the theory will be briefly presented and several concepts which other food system researchers have found particularly in explaining firms' behavior (see Hamm, 1981; Schmelzer, 1983; and McLaughlin, 1983).

Cyert and March have the following difficulties with the neoclassical theory of the firm: 1) the motivational assumption of profit maximization; 2) cognitive assumptions ignore the real world uncertainty of present and future events; and 3) the fact that few characteristics of the theoretical firm coincide with actual features of business firms. They responded to these shortcomings by constructing an alternative approach for analysis of organizational decision making. The behavioral theory of the firm developed by Cyert and March contained subcomponents focusing on organizational goals, expectations, and choice. Their theory or organizational choice is most relevant for this study since the aim is to understand how firm decision making occurs so that implications of firms' actions for the vertical market system can be assessed.

Cyert and March propose that firms are constrained by environmental uncertainty, difficulties in maintaining intrafirm coalitions, and by its own limited capacity for acquiring, storing, and utilizing information. Following Simon, they characterize the firm as an adaptive institution which learns from its experiences. The authors argue that the short-run adaptive process of firms can be examined by observing the standard operating procedures (SOPs), which are an accumulation of the firms' behavioral responses, or more simply, the organization's memory. SOPs can be viewed as rules of thumb which the firm has developed to reduce the transaction costs of reaching collective decisions in an uncertain and complex environment. Such "shortcuts" formulated to guide policy have long been observed in studies of firm business behavior.[28,29] Cyert and March argue that SOPs are stable and give direction to activities which the firm is repeatedly faced with and, in the short-run, dominate firm decision making. Shaffer interprets SOPs as "political solutions reconciling the differences in perceptions and preferences of various participants."[30] He asserts that SOPs are stable to the extent that firm members' goals are met.

B. Types of Standard Operating Procedures

Cyert and March identified four major categories of SOPs.[31] First, task performance rules specify the methods for accomplishing the tasks assigned to individuals and groups within the organization. These rules transmit accumulated learning and by making behavior of members performing different activities more predictable, thereby enhancing intrafirm coordination. Many such rules have broader relevance and can be regarded as standard industry practices. Second, record maintenance SOPs keep

continuing records of internal activities usually deemed most important in the firm.

Third, information handling rules specify the way in which information, largely externally generated, is transmitted through the firm. These rules represent the firm's internal communication network and determine what information is collected, how it is condensed and filtered, and to whom it is distributed. Since this category of SOP determines what information is both taken in and generated to external entities, these rules critically affect the activities of other entities and, therefore, vertical coordination in the marketing channel. Fourth, firms have rules for planning which reflect their firm's goals, its time horizon, and precedents.

C. Some Relational Concepts

A set of concepts is needed which relate variables suggested by a theory of firm behavior presented in the previous sections. Cyert and March suggest four such relational concepts: 1) the partial resolution of conflict among internal firm coalitions having diverse interests; 2) firms avoid uncertainty by reacting to short-run feedback to the exclusion of strategizing to deal with longer-term uncertainty; 3) firms' search processes are initiated by the recognition of a problem and search is oriented to acceptable rather than optimal goals; and 4) organizations learn, adapt, and evolve through conflict resolution, by avoiding uncertainty, and employ search processes for solving problems.[32]

McLaughlin, using the behavioral theory of Cyert and March to develop a framework for studying vertical coordination, identified two additional recurring relational concepts: information and control.[33] The vertical marketing system can be conceptualized as a conduit for the

flow of physical commodities and information. The informational flow dominates since it is necessary for any physical flow to occur. McLaughlin identifies three crucial dimensions of information which affect the vertical coordination process: 1) timeliness; 2) quality; and 3) completeness. The institutional coordinating arrangements affect these three dimensions and, thus, the level of coordination achieved.

Control is a final important relational concept. It is closely intertwined with information. Hamm defines control "as the ability to direct the flow of decisions."[34] Horizontal control or market power is the more commonly accepted and studied form of control. Horizontal control is a function of size within a defined market. Firms having such power are able to acquire the resources needed to affect vertical control through obtaining information, vertically integrating or influencing the political system to change the rules.

Vertical control can exist independent of horizontal control.[35] This power can come from being strategically located in the vertical system so to have access to certain information. For example, the proximity of distributors to consumers provides them access to demand information which gives them an advantage in bargaining relationships with manufacturers. The collection and analysis of consumer sales information afforded by UPC scanning appears to be shifting the locus of power.

The above discussion has illustrated the interrelationship between information and control. The relationship is reciprocal. Parties with power have the ability to obtain information. Conversely, those having strategic access to information can acquire power.

D. The Relationship of SOPs to Vertical Coordination

SOPs are the focus for control within the firm and actually direct firm decision making in the short-run. As such, they provide a link between individual decision making within the firm and vertical coordination processes occurring within a subsector. If a key decision maker's SOPs are identified and documented, their implications for vertical system coordination and performance can be assessed.

2.5.3 Obstacles to Vertical Coordination

Several obstacles to the process of vertical coordination are described in this section. The three categories are by no means exhaustive, but rather represent obstacles most relevant for studying the adoption of cost-reducing innovations.

A. A Fundamental Problem: External Effects

A very basic problem of organizations and, for that matter the economy as a whole, is the existence of external effects. Shaffer summarizes the fundamental organizational problem in the following way:

> The individual participant is exposed to only a small portion of the aggregate opportunity set, and only some of the consequences of behavior accrue to the individual. That is, the individual acts on the environment in terms of his perceptions of the consequences. Perceived consequences which will be the most immediate and act as incentives will be those which fall directly on the participant and are directly linked to specific behavior.[36]

The challenge to managing a system, be it an organization or the entire vertical marketing channel, is to structure the opportunity sets, or contingencies of reinforcement, so that individual behavior yields results which coincide with the goals of the larger system. In other terms, the problem is to determine which consequences of actions should be taken into account in individual decisions in order to attain desired

overall performance. This task is made difficult because individuals' actions have complex uncertain consequences, often separated in time and space. Thus, causal connections are extremely difficult to establish.

External effects can act as a barrier to vertical coordination processes occurring both within and between firms. In the case of internal firm coordination barriers, decisions made in one functional area of the organization which do not take into account effects on other areas result in higher total costs and lower profits for the firm. The difficulty of controlling and coordinating the behavior of different functional units to improve overall performance of an organization has been described by several authors. Simon identified the phenomenon of "subgoal pursuit" where individuals pursue localized goals within the firm which can be at odds with achievement of the organization's global goals.[37] A similar problem is defined in the broader context of policy implementation by Schon:

> A game tends regularly to be played between the center and periphery in which the interest of the center is to impose some systems rationale; some policy, on persons at the periphery, while the interest of persons on the periphery is to divert resources to their real local interests as they perceive them.[38]

The SOPs of decision makers in various functional units within a firm reveal which effects are internal and external to there decisions. Therefore, the documentation of SOPs sheds light upon possible effects of decisions made in one part of a firm which increase total firm costs. As noted earlier, SOPs represent the political resolutions among different intrafirm coalitions having divergent interests. Consequently, the SOPs can reveal information about which particular functional

coalitions are the most powerful. The existence of influential coalitions of decision makers which create significant external effects can be a barrier to improved intrafirm coordination. Alternatively, SOPs might be viewed as the outcome of top management's efforts to coordinate the actions of different functional areas to achieve overall firm goals.

The consequences of external effects between firms have been discussed at length in the economics literature. The implication of externalities is that the economic signals generated through a vertical system cause some resources to be overproduced while others are not produced at all. If decision makers do not take into account significant externalities and these effects are not reflected in prices and costs, the necessary information and incentives will not exist to achieve coordination of consumer preferences with production possibilities. Externalities can be thought of more generally as problems of institutional failure in which institutions fail to provide a mechanism for articulating preferences.[39]

B. Transaction Costs and Information

The importance of information in the coordination of vertical systems has been stressed. This section identifies potential coordination problems that can arise involving information. Information is treated as an additional cost of making a transaction. Also, the impact of the cost of obtaining information upon different institutional mechanisms for vertical coordination is discussed.

Coase, a pioneer in the investigation of transaction costs, was intrigued with the question of why some transactions are carried out through markets and other transactions are carried out through firms. He argued that firms arise and supplant certain markets (bargained) with

command transactions because "there is a cost to using the price mechanism."[40] Such costs can be related to information discovery, contract negotiation, and risk. Thus, the existence of firms can be explained as an attempt to economize on transaction costs.

Schmid defines transaction costs as the cost of human interaction.[41] He distinguishes among three types of transaction costs: contractual, information, and policing. Schmid points out that institutions (property rights) determine the incidence of transaction costs among participants. Property rights determine who has to bid to whom. The differential bearing of transaction costs creates opportunities for some parties and constrains the opportunity sets of others. For example, if one party to a potential exchange faces significant transaction costs, a bid is unlikely to be forthcoming. Thus, the other party retains use of the resource. In summary, the incidence of transaction costs, which are a function of existing property rights, determines how resources are used and who benefits from their use.

Williamson has contributed significantly to the study of transaction costs and organizational innovation. Williamson has generalized the firm-market dichotomy and has advanced the hypothesis that "transactions are assigned to and organized within governance structures in a discriminating (transaction cost economizing) way."[42]

The analysis of Williamson is based upon two assumptions: bounded rationality and opportunism (i.e., self-interest seeking with guile). He proposed that when bounded rationality and opportunism simultaneously exist in an atmosphere of uncertainty that a condition of impacted information results. If these conditions occur in a small numbers competitive setting, prohibitive contracting costs acts as an

incentive to bring the transaction inside the firm. An important advantage to such hierarchical organization includes a reduction in the incentives to behave opportunistically in which subgroup gains are obtained at the expense of the overall system.[43]

Williamson further develops his analysis by identifying three characteristics of a transaction which determine whether firms will be preferred over markets as governance structures.[44] They are: 1) uncertainty; 2) the frequency of transactions; and 3) the degree to which transactions involve durable transaction-specific investments.

The third characteristic, also called idiosynchratic investments, is deemed the most important by Williamson. As assets become specialized to a single transaction, the parties become more interdependent and a bilateral monopoly relationship is approached. Thus, transactions requiring assets specific to the transaction are not easily executed through market contracting. Assurance of a continued relationship is needed for investment in transaction-specific assets. Long-term contracts could be developed, but because of bounded rationality, they would be incomplete since not all contingencies can be specified at the outset. Williamson notes that the need to adapt to changing conditions and the existence of opportunistic behavior make such contracting unworkable.[45] He states that governance structures which attentuate opportunism are needed to make market contracting workable. As noted, hierarchical (firm) structures can reduce incentives to behave opportunistically.

Several observations of Williamson including information impactedness and the conditions (bounded rationality and opportunism) leading to incomplete contracts could be useful in diagnosing problems with

existing vertical coordination mechanisms. In particular, Williamson's hypothesis about the problems of market transactions which require idiosyncratic investments by one party seems applicable to major inter-industry changes such as modular packaging. This hypothesis will be explored in the research.

C. Organizational Slack

Lang identified imperfect competition leading to the existence of organizational slack as an obstacle to vertical coordination.[46] The concept of slack dates back to Simon's postulate that firms had satisfactory profit goals rather than optimal ones.[47] Cyert and March first introduced the concept of organizational slack. Slack can be viewed as resources which are funneled to the satisfaction of individual and subgroup goals in order to maintain a coalition between diverse subgroups in the organization.[48] Thus, firms may sacrifice some technical efficiencies in order to maintain good interpersonal relations within their firm.

Leibenstein discussed the causes and consequences of slack in his classic article on "X-inefficiency." He argues that the uncertainties surrounding the production function and the non-marketability of some firm inputs are two factors which contribute to "X-inefficiency."[49] This general notion is that firms and the economy in general do not perform at their full capability or, in other terms, at the outer limit of their production possibility surface.

> Rather they actually work on a production surface that is well within that outer bound. This means that for a variety of reasons, people and organizations work neither as hard nor as effectively as they could. In situations where competitive pressure is light, many people will trade the disutility of greater effort, of search, and the control of other peoples'

> activities for the utility of feeling less pressure and better interpersonal relations.[50]

Leibenstein concludes from his analysis that the potential gains in output from improvements in "X-efficiency" are likely to be large compared to gains associated with increasing allocative efficiency.[51]

The relationship between organizational slack and vertical coordination has been analyzed by Lang.[52] In a study of grower-first handler bargaining, he identified numerous unexploited opportunities for reducing the two parties' joint costs. An important question raised was: Why didn't handlers attempt to alter the exchange arrangements to capture the benefits of these opportunities? Lang suggested that the opportunities were not seized because of organizational slack in firms in the imperfectly competitive first handler market. It was hypothesized that "employers or managers in buying firms may simply trade off the effort required to seek out better coordination and lower cost arrangements in favor of less personal pressure on the job."[53] Further, Lang suggested that countervailing power may cause firms to reduce slack and, thus, induce them to seek out ways which reduce joint costs. He found some empirical support for this hypothesis in that buying firms studied did not undertake efforts to rewrite contracts to reduce joint costs without the pressure of collective bargaining.[54]

A general hypothesis can be constructed which links horizontal market structure to internal firm organization and, in turn, to vertical system coordination. The market structure of an industry may not provide the competitive pressures for a firm to change practices or coordination mechanisms even though such changes would increase the firm's technical efficiency. The implication is that organizations with

significant levels of slack are less likely to make efforts to implement innovations which lower their costs and, potentially, total system costs.

2.6 Concepts for Analyzing Adaptation in a Vertical System

In the previous section, a set of theoretical concepts were brought together for analyzing vertical coordination in a traditional synchronizing sense. This framework focused on the relationship between firms' micro decisions and macro implications for the broader vertical system. This approach is adequate for studying simple interindustry innovations. However, the analysis of industry-wide systems innovations requires a broader approach which can encompass the relationships between firm (micro) decision making and collective (macro) decision making at a horizontal industry level. While Section 2.7 analyzed the synchronization dimension of vertical coordination, the focus here is on factors affecting the adaptation of a vertical system to large-scale system-wide change.

2.6.1 A Horizontal Micro-Macro Orientation

As alluded to, the orientation is that of a horizontal "systems" perspective. The purpose is to enhance the vertical "systems" perspective set forth earlier in discussions of vertical coordination. The reason for the expansion is to account for some unique characteristics of interindustry changes which require "industry-wide" adoption at one or more horizontal levels to produce any benefits in the food marketing system.

The approach also stresses the link between firm level (micro) decisions and a collective (or horizontal systems or macro) viewpoint. Recall the problems of external effects for the organization of firms

and the vertical marketing system. The same fundamental problem is relevant here--only in a horizontal context. That is, only some of the effects of a firm's action accrue to the firm. Of those effects which are perceived by the firm, those which are most immediate and direct will act as incentives. Consequently, the consequences which an individual firm takes into account in its decisions may lead to a longer-term result which is undesirable from the point of view of the industry as a whole.

The phenomenon described above could be generically described as a problem where micro decisions do not lead to desired macro results. The phenomenon has been identified by a number of authors representing several disciplines. Hardin wrote the "Tragedy of the Commons" characterizing a general situation in which individuals in pursuit of their own interest continue to behave in a way that results in all individuals collectively being worse off.[55] Schelling has identified numerous similarities of relations between characteristics of individual behavior and that of the aggregate to which the individual belongs.[56]

Platt, a psychologist, coined the term "social trap" for situations in which participants "get themselves started in some set of relationships that later prove to be unpleasant or lethal and that see no easy way to back out of or avoid."[57] Using behavioral reinforcement principles, he was able to develop a taxonomy of traps. One important class is that of a countertrap or "social fence" in which the pursuit of individual gain prohibits an individual from taking an action which would benefit the group as a whole. Behavior which can lead to this type of trap is elaborated in Section 2.6.4 which draws upon Olson's work on collective action.[58]

2.6.2 Costs of Communication and Collective Decision Making

Common problems can be recognized by most or all firms at an industry level, but an implementable solution to the problem is unlikely to emerge on its own. Participants must first agree on the dimensions of the problem. Second, they must reach a concensus on a general solution. Third, the solution must be taken from a general concept to a specific implementable alternative.

This process could be termed a collective preference formation process. The process is expensive because of the high costs of human interaction (transaction cost) involved in becoming aware of and communicating about a problem's dimensions and possible solutions. Also, there are costs of reaching an agreement on a desirable solution and its specific form. These transaction costs will be greater for more heterogeneous groups. Thus, in a diverse industry such as food distribution, the process of collective preference formation is costly.

The existence of preference formation costs is a first level barrier to the adoption of industry-wide innovations. The following two sections assume that participants have identical preferences for a specific implementable innovation and concentrates on problems of preference articulation.

2.6.3 The Non-Marginal Nature of Industry-Wide Innovations

A fundamental characteristic of some innovations is that all or most of the participants in a group must adopt them in order for any benefits to be generated. This type of innovation is referred to as an industry-wide innovation. The term industry-wide refers to the horizontal aspect of the innovation.

A basic notion is that the benefits of industry-wide innovations depend upon a significant proportion (threshold) of participants in the industry adopting the innovation. Thus, no individual can produce results alone. This idea has been expressed in several different ways. Schelling used the term "critical mass" for general situations in which the behavior of individuals depends upon how many other people are behaving that way.[59] Cross and Guyer refer to such situations as a particular form of social trap termed collective externality countertraps.[60] For example, a person may avoid shovelling his/her sidewalk because doing so involves a cost and benefits of the action alone provide few benefits. However, if everyone would bear the cost of shovelling their walk, then the benefit is multiplied and would exceed the total costs incurred. Shaffer characterizes the problem in a marketing system context as a variation of an externality/public good problem "in which collective action would provide an economic benefit to the system, but no individual acting alone can either produce or capture the benefit alone."[61]

2.6.4 The Indivisibility of the Benefits of Industry-Wide Innovations

Given that firms in an industry have a preference for the benefits of an innovation, it is logical to expect them to put forth effort toward implementing the change. However, when the benefits of action are shared with others, or are indivisible, actions by rational individual firms to implement the innovation may not be forthcoming.

Olson has developed a theory of group action which provides insight into the situation outlined above. He proposes that in large group

situations a paradox occurs: "Large groups, at least if they are composed of rational individuals, will not act in their group interest."[62]

Olson's line of reason is as follows. First, the fact the goal being sought is commonly shared by all members of a group implies that its achievement will benefit everyone in the group. The benefit is akin to an indivisible, or in layman's terms--"public good," which if provided to one, goes to all in a relevant group. Second, any individual who incurs a cost to advance the cause only receives a minute share of the gain. Third, the indivisible benefits of action implies that those who don't put effort towards the goods' provision gain as much as those who do. Fourth, rational individuals, recognizing they can enjoy benefits without incurring costs, will act as "free riders." Therefore, no action will be forthcoming to achieve the group's goals.

The above result need not always hold. Olson argues that action in the common or group interest can occur when selective incentives exist. Such an incentive "applies selectively to the individuals depending on whether they do or do not contribute to the provision of the collective good."[63] A second factor is group size. As the number of individuals decreases, the share of the gains which accrue to an individual firm increases, thereby increasing the incentive for action toward the group interest.

Olson notes that in some small groups with socially interactive members social selective incentives can exist.[64] These negative (e.g., censure) or positive (e.g., respect) selective incentives can lead efforts to further common goals. Social-selective incentives can be very effective, but are limited by the group's heterogeneity. Diversity

means that members are less able to reach a concensus on the exact nature and quantity of the collective good desired.

2.7 Chapter Summary

The principle components of an analytic framework for analyzing system-wide change were presented in Section 2.1. Fundamental to the framework was a "systems" perspective which encompassed vertical (interindustry) and horizontal (industry-wide) dimensions of the food marketing system. A taxonomy of systems innovations was developed. Important classes included: 1) simple interindustry; and 2) industry-wide systems innovations.

A simple model in which modularization was conceptualized as a problem of exchange between manufacturers and distributors was set forth in Section 2.2. The model's initial simplifying assumptions were relaxed and it was expanded in a horizontal and vertical fashion in order to more closely approximate the actual interfirm and intrafirm relationships in the food marketing system. The model examined typical demand and supply factors and the level of transaction costs in several different simple market structure model variations. In a multifirm distributing and manufacturing sector model, the difficulty of horizontal coordination among competing firms and the high costs of collective decision making in heterogeneous groups were identified as barriers to the exchange necessary for modular packaging to be adopted.

Expansion of the model in a vertical dimension further illustrated the complexity of the exchange process needed for modularization to be implemented. For exchange to occur, an entire sequence of vertical transactions must effectively transmit information to the manufacturer-distributor interface. The potential effects of competition upon

distributors' incentives (i.e., reward of cost savings) to make a bid and manufacturers' incentives (i.e., reward of increased sales resulting from lower prices and payment for cost saving packaging by distributors) to offer modular sizes was assessed.

Several research assumptions and a classification of theoretical concepts for analyzing vertical coordination were presented in Sections 2.3 and 2.4, respectively. The classification system divided vertical coordination into two levels of focus: synchronization and adaptation. Section 2.5 presented a set of concepts from vertical coordination and organizational theory for analyzing synchronization of individual decisions of firms in the vertical system. This subcomponent of the framework was proposed for studying simple interindustry innovations. Section 2.6 presented a set of related analytical concepts for studying the adaptation dimension of vertical coordination. This subcomponent of the framework emphasized the coordination of individual firm decisions within the horizontal industry necessary for adaptation to large-scale industry-wide innovations. The two subcomponents (Sections 2.5 and 2.6), when taken together, are proposed as an initial framework for analysis of the complex process of system-wide innovation.

CHAPTER 2

FOOTNOTES

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[58]Mancur Olson, The Rise and Decline of Nations, New Haven, CT: Yale University Press (1982).

[59]Thomas C. Schelling, Micromotives and Macrobehavior, p. 95.

[60]John G. Cross and Melvin J. Guyer, Social Traps, Ann Arbor: University of Michigan Press (1980), p. 31.

[61]James D. Shaffer, "Designing Agricultural Marketing Systems in Developing Countries," Michigan State University Agricultural Economics Staff Paper No. 72-3 (1972), p. 5.

[62]Mancur Olson, The Rise and Decline..., p. 18.

[63]Ibid., p. 21.

[64]Ibid., pp. 23-24.

CHAPTER 3

DATA ACQUISITION METHODS

3.1 The Research Approach

The data needed to accomplish the research objectives set forth in Chapter 1 were drawn from a number of diverse sources. Secondary data were collected through a comprehensive literature search. Primary data for the study were acquired through an extensive set of personal interviews and a limited number of phone interviews with firm managers and industry leaders. Data collection proceeded in three phases. The first phase of the study consisted of a review of relevant secondary data and a set of exploratory interviews with food industry trade association representatives and U.S. Department of Agriculture personnel. The second phase consisted of a limited number of pilot interviews with personnel in food manufacturing, distributing, and materials handling equipment companies. The third and final phase involved an extensive set of personal interviews with firm managers and executives in major food manufacturing and distributing firms in the U.S. Toward the end of this phase, the trade association representatives were reinterviewed. Also, a number of shorter phone interviews were conducted with persons referred to by interviewees.

3.2 Literature Search

The primary purpose of the literature search was to determine the extent of available knowledge on the topic of modular packaging. In

particular, information was desired on: 1) effects (benefits and costs) of modularization of secondary packaging; and 2) factors which have impeded its adoption in the dry grocery segment of the U.S. food industry. A secondary purpose of the literature search was to assemble available background information on the dry grocery distribution system including: 1) its structure and characteristics of major participants; 2) performance of different stages within the system; and 3) industry trends.

Secondary data sources which proved to be useful included industry trade journal publications (e.g., Supermarket News and Grocery Distribution), government reports, and academic texts and journals. A valuable source was that of consulting firm reports, several of which were either identified or provided by trade association representations or other interviewees. While use of published indexes (e.g., Packaging Abstracts and Food Marketing Index) was relied upon, access to the libraries and files of several organizations[1] increased the comprehensiveness of the review.

The results of literature review provided a foundation for the primary data collection. First, the results assisted in identifying organizations and, in some cases, individuals to be included in the interview sample. Second, it permitted the development of a knowledge base and vocabulary necessary to establish credibility and communicate with industry personnel. Finally, the review identified factors and hypothesis relating to modular package adoption. These were used in the formulation of themes of inquiry pursued in the interviews.

3.3 Field Interviews

As noted, personal field interviews was the vehicle used for acquiring primary data. The rationale for this approach, interview design, the sample selection procedure, and the interviewing process are discussed in this section.

3.3.1 Rationale for the Approach

The decision to employ an interviewing technique was based upon a number of considerations. A fundamental reason for this choice was the problem-solving orientation of the study. The pragmatic focus of an institutional perspective, upon which this research draws, suggests that problem solving requires interaction with parties affected by a particular problem. This is necessary to understanding the full dimensions of the problem, the incidence of the effects of possible solutions, and the workability of solutions proposed. Personal interviews were deemed an ideal vehicle to achieve the needed interaction.

A second reason why field interviews were utilized concerned the type of information which was desired. Data were needed to verify the thesis of the research--that existing institutions have not adjusted to new technological possibilities. In terms of a vertical system, the present institutional arrangements may be ineffective in coordinating the vertical stages in order to yield an efficient total system. Institutions determine what is taken into account and, thus, affect firm decision making behavior and this, in turn, affects adjacent firms in the vertical system and total system performance. SOPs are part of the institutional structure which guide individual decision making. SOPs are observable and can be documented. Several hypotheses regarding relationships between distributor product procurement, pricing, and damage

handling SOPs, and modular package adoption were proposed in the initial phase of the study. Based on the success of past food system researchers[2,3,4] who have utilized participatory interviewing techniques for documenting SOPs, this method was adopted for use in this study.

The personal interview technique had several other practical advantages. First, it enabled the researcher to observe first-hand the problems resulting from shipping container size proliferation, an experience impossible through a mail survey. Second, the personal nature of the interviews was a factor which increased the interest of respondents in participating in the study. This was a particular advantage in inquiring about a subject that was outside the realm of everyday operating activities. The response rate for inquiring via a mail survey would likely be low on such a topic.[5] Third, the interviews were evolutionary in leading to the identification of a number of alternative factors, and hypotheses which would not have been possible through a one-time mail questionnaire.

3.3.2 Interview Design

The interview design had two levels of focus. The first focus was a broad one. Individuals representing a range of participants likely to be affected by modularization or likely to be involved in implementation were interviewed. They included package suppliers and manufacturers, brokers, distributors, and materials handling equipment suppliers. Interviews were conducted primarily with trade associations representing these parties. Also, firms and individuals which were identified as having special expertise in the general area of physical distribution and, specifically, in modularization, were interviewed. Several

academic researchers, consulting firms, and government officials fit into this category.

The second and major focus of the field interviews concentrated on two parties: manufacturers and distributors. Since these two parties are located on either side of a transaction, the "mirror image" technique for collecting qualitative data through interviewing was adopted.[6] The technique involved questioning decision makers who are parties to a transaction concerns activities within a particular theme of inquiry, but from the perspective from which they operate. Its purpose is to provide a check on the accuracy of responses in small samples characteristic of research involving personal interviews. Also, as Hamm notes, the technique permits the identification of misconceptions on either side of a buyer-seller interface.[7]

The "mirror image" method was designed for use in interviewing individuals (buyers and sellers) who engage in a transaction. In this research, the technique has been adopted for use in a more general way. The interviews were directed at individuals most familiar with problems of container size proliferation and with the topic of modular packaging in manufacturer and distributor firms. These people were physical distribution executives and managers, but in several cases, included buyers and top executives. Typical job titles of interviewees included: vice-president of distribution, vice president of logistics, director of distribution planning, warehouse manager, head buyer, and merchandising manager.

3.3.3 Sample Selection Procedure

The procedure of selecting firms for the sample of manufacturers and distributors for the interviews proceeded in both a purposeful and

ad hoc manner. After the initial phase consisting of literature review and exploratory interviews, several criteria were set forth for selection of a purposive sample. The most important of these criteria was sales volume. Choice of this criterion was based on the observation of several knowledgeable food system researchers that the largest firms play a key role in the process of industry-wide innovation. The hypothesis is that if a small number of key firms representing a large volume of sales support a cause, this leadership stance will cause a "snowball" effect and the remaining firms will follow. Thus, data on firm sales volume was assembled for manufacturing firms (Directory of the 200 Largest U.S. Food Manufacturers and Tobacco Processing Companies in the U.S., 1975, and Food Processing, December 1982) and distributors (Chain Store Age, July 1983) for use in selecting interview companies.

A second criterion was organizational type. For manufacturers, it was desired to have brand suppliers and private label suppliers in the sample. Two different types of distributors were included in the sample: wholesalers (voluntary and cooperative) and chain store organizations. The reason for including both types was to detect differences in response due to differences in organizational type. Another reason retail chains were included was to explore possible effects of modularization at the retail level.

A final criterion related exclusively to distributors. In order to explore possible differences in responses, both mechanized/automated firms and those operating conventional warehouses were included in the sample.

The above criteria were proposed at the outset to direct the firm selection process. However, several other factors influenced the firms

actually interviewed. First, during the pilot interview stage of the research, the value of referrals in obtaining interviews became apparent. Thus, considerable effort was spent in developing contacts for the final extensive set of interviews. Academic and government researchers, as well as a number of industry organizations,[8] provided contacts. When an interview was desired with a particular firm, but no referral existed, the strategy was to contact the highest ranking official (president, chief executive officer) and request assistance in identifying a person within the firm to interview. This approach worked in most cases.

Second, some interviewees had suggestions about other persons in the industry for future interviews. Through this type of referral, a number of interviews resulted. Thus, the sample evolved in an ad hoc fashion. A final consideration which affected the firm selected was that of location. In general, the firms chosen were located in metropolitan areas where at least one or more food manufacturers were located.

In total, 95 individuals in 54 supplier and distributor firms were interviewed. The manufacturer and distributor companies in the sample are shown in Tables 3.1 and 3.2, respectively. More distributors are represented in the sample than manufacturers. Several reasons for this are offered. First, fewer manufacturers than distributors were located in most of the metropolitan areas visited. Second, the distributor sector is generally more accessible than the supplier sector. Third, distributors were more willing to be interviewed on this topic, perhaps due to benefits which would accrue to them.

An additional 26 personal interviews were conducted with individuals in 17 other food industry-related firms and organizations. Table 3.3

Table 3.1 Manufacturer Sample

Firm	Number of Firms Interviewed	Number of Individuals Interviewed	Rank*
General Foods Corp.		1	1
Beatrice Food Co.		2	2
Ralston Purina Co.		1	9
CPC, International, Inc.		1	11
H.J. Heinz Co.		2	12
Borden, Inc.		1	18
General Mills, Inc.		2	20
Kellogg Co.		3	25
The Procter & Gamble Co.		1	28
The Pilsbury Co.		4	30
The Quaker Oats Co.		1	31
IC Industries, Inc. (Pet)		1	33
Curtice-Burns, Inc.		4	84
Gerber Products Co.		2	92
Stokely-Van Camp, Co.		2	N.A.
R.T. French Co.		3	N.A.
J.M. Smucker Co.		2	N.A.
TOTAL	17	33	

N.A. - Not Available

*Rank based on 1983 food sales excluding tobacco. "Food Processing's Top 100 Food Companies Annual Report," Food Processing, December 1983.

Table 3.2 Distributor Sample

Firm	Number of Firms Interviewed	Number of Individuals Interviewed	Rank*
Supermarket Chains			
Kroger		2	2
Jewel		1	5
A & P		1	7
Grand Union		2	9
SGC (Pathmark)		3	11
Giant Food		1	14
Stop & Shop		1	18
Borman's (Farmer Jack)		2	23
Red Owl		1	29
Schnucks		1	30
Big Bear		1	33
Shaw's		1	38
Wegman's		1	40
Fisher Foods		2	43
Giant Eagle		1	46
Marsh		1	59
Meijer		3	61
Chatham		3	64
Total Chains	18	28	
Wholesalers			
Fleming		4	2
Wakefern		1	3
Wetterau		1	4
S.M. Flickinger		2	7
Associated Wholesale Grocers		3	8
Super Food Services		1	10
Spartan Stores		7	12
Certified Grocer's of Illinois		2	16
Springfield Sugar		1	26
Peter J. Schmitt		2	32
Gateway Foods		1	36
American Seaway		1	38
Allied Grocers Coop		1	47
Scot Lad Foods		1	N.A.
Nash-Finch		1	N.A.
P & C Food Markets		2	N.A.
Bozzutos		1	N.A.
SAV-A-LOT		1	N.A.
Food Marketing Corp.		1	N.A.
Total Wholesalers	19	34	
GRAND TOTAL	37	62	

N.A. - Not Available

*Rank based on 1982 sales volume (including international operations) as reported in "1983 Supermarket Census," Chain Store Age Supermarkets, July 1983, pp. 20-29.

Table 3.3 Other Interviews

Organization	Number of Organizations Interviewed	Number of Individuals Interviewed
Materials Handling Equipment Suppliers		
Rapistan		1
Sl Handling Systems		3
Total	2	4
Consulting Firms		
Cleveland Consulting Assoc.		1
Gagnon and Assoc.		2
Total	2	3
Buying Organizations		
TOPCO Assoc.		3
Shurfine Central Corporation		1
Alliance Assoc.		1
Federated Foods		1
Total	4	6
Trade Associations		
Grocery Manufacturers of America, Inc.		2
Food Marketing Institute		2
National-American Wholesale Grocers' Association		2
National Grocers' Assoc.		2
Fibre Box Assoc.		1
United Fresh Fruit and Vegetable Assoc.		1
American National Metric Council		1
Total	7	11
Academic (Excluding Michigan State)		
Massachusetts Institute of Technology		1
The Ohio State University		1
Total	2	2
GRAND TOTAL	17	26

lists these additional interviews. Altogether, 121 persons in 71 different organizations were interviewed in the course of the study.

3.3.4 The Interviewing Process

Once the appropriate firms and individuals were identified, an interview request was made. Approximately three weeks before the planned interview a letter and project summary was mailed that described the research, its potential benefits, and a request for the firm's participation in the study. The materials sent to the firm indicated that the information obtained would be used with no attribution to the firm and individuals interviewed. Furthermore, a research report would be provided in return for their cooperation. Also, several specific meeting dates and times were suggested. The letter and project summary statement can be found in Appendix A. About a week before the scheduled interview a phone call was made to confirm the interview, answer any questions about the study, and obtain directions to the firm. Follow-up letters of thanks were sent to interviewees.

In general, the interview request procedure worked fairly well. Only in a few cases were interview requests flatly denied. The reasons offered in such instances included: 1) the firm had a policy of not participating in such surveys; and 2) that no individual had time to participate. Several interview requests were granted, but later cancelled.

The interviews were conducted in a semi-structured participatory format. Interviews consisted of six parts: 1) background of the firm and its operations; 2) awareness of the container size proliferation problem; 3) awareness and understanding of the modular concept; 4) its probable effects; 5) themes of inquiry; and 6) necessary conditions for implementation. A guide outlining the interview structure can be found

as Exhibit 2 in Appendix A. The interviews were conducted in a non-directive fashion. Enough flexibility was permitted for interviewees to describe the problem in their own terms, identify critical factors, and suggest potential solutions. In almost every interview, all six were covered, although they were not always in sequence.

The primary focus of the interview consisted of the themes of inquiry. This part of the interview typically began by asking the question: If there are such substantial savings to package modularization, then why doesn't it happen? Most interviewees were able to enumerate a number of factors which affected modular container adoption. In the discussion which ensued, themes of inquiry derived from the literature review and conceptual framework were introduced. The set of themes were:

- History of modularization
- Technology of food packaging and distribution
- Economic factors
- Marketing and merchandising factors
- Competitive factors
- Intra-firm information handling
- Inter-firm information handling
- Research
- Trade associations
- Government

In most cases, a majority of the themes were covered, but this varied depending on interview length. Toward the end of the meeting, the interviewee was asked to summarize by identifying the most significant barriers to modularization. The final part of the interview was to

ask the respondent to hypothesize what conditions were necessary for modular packaging to be adopted.

The level of cooperation of firms which were included in the sample varied, but was generally quite high. The length of interviews ranged from one hour to four hours, with an average of approximately one and one-half hours. In many cases, the interviewee either gave a personal tour or arranged for another employee to tour the firm's facilities. In a few instances, the interviewee brought other persons to the meeting or arranged a later time for meeting with the individual.

CHAPTER 3

FOOTNOTES

[1]Such organizations included the Food Marketing Institute, National Council of Physical Distribution Managers, and the American Institute of Food Distribution.

[2]Larry G. Hamm, Food Distributor Procurement Practices: Their Implications for Food System Structure and Coordination, unpublished Ph.D. Dissertation, Michigan State University (1983).

[3]John R. Schmelzer, Large Limited-Menu Foodservice Firms: Market Structure Changes and Procurement Practices for Beef and Poultry, unpublished Ph.D. Dissertation, Michigan State University (1983).

[4]Edward W. McLaughlin, Buying and Selling Practices in the Fresh Fruit and Vegetable Industry: Implications for Vertical Coordination, unpublished Ph.D. Dissertation, Michigan State University (1983).

[5]Some evidence exists to support this hypothesis. A mail survey conducted in the first phase of the joint industry study on shipping container design improvements was sent to all members (over 1,000) of the participating trade groups and only 55 distributors and 35 manufacturers responded. See A.T. Kearney, Inc., "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at National American Wholesale Grocers Association Warehouse Operations Seminar, Dallas, TX (December 4, 1984), p. 4.1.

[6]Wayne D. Purcell, "An Approach to Research on Vertical Coordination: The Beef System in Oklahoma," American Journal of Agricultural Economics, Vol. 55, No. 1 (February 1973), p. 66.

[7]Larry G. Hamm, Food Distributor Procurement Practices..., p. 90.

[8]Such organizations included the National Council of Physical Distribution Managers, Grocery Manufacturers of America, Inc., and National-American Wholesale Grocers Association.

CHAPTER 4

A MODULAR SYSTEM OF FOOD PACKAGING

This chapter serves as an introduction to the remainder of the thesis. The discussion draws primarily upon information acquired through an extensive literature search. The problem of shipping container size proliferation is explained. A potential solution, modular packaging, is defined, its history traced, and current status appraised.

4.1 The Problem of Shipping Container Size Proliferation

Food manufacturers' decisions about retail package shape and size have an impact upon receivers' (wholesale and retail chain distributors') physical distribution operations and ultimately affect consumer food prices. Suppliers design packages to meet the needs of their individual product. A food item's inherent shape and density, its end use, and the portion desired by certain consumer segments determine the item's retail package size. Packages are designed for marketing reasons. The physical dimensions of the package are important product attributes which can be varied to differentiate products.[1] In addition to influencing a consumer's image of a product, package dimensions affect the amount of exposure a product receives on a supermarket shelf. One analogy is that packages are "billboards" which attract the eye of passing shoppers. A second way in which marketing affects package size is through consumer price perception and reaction thresholds.[2,3] For many products there are

certain price levels, such as $1.00, which when reached, cause consumer purchases to sharply decline. A manufacturer, respecting these threshold points, manipulates the variables of product quantity and package size to yield a product which will be priced at retail below these critical price thresholds.[4]

A supplier considers these factors for its particular product and produces an individualized retail package. A particular number of retail packages, traditionally a multiple of a dozen (e.g., 24, 36, or 48) and referred to as a case pack, are combined and enclosed in a larger unit, the shipping container (case). The dimensions of the shipping container reflect the product's retail package dimensions and vary considerably in shape and size. Cases are then aligned horizontally in a certain pattern to fit on the standard 48 by 40 inch grocery pallet. These tiers are then stacked upon one another in alternating patterns to form an interlocking unit load.

The diversity in shipping container size is not of critical importance for supplier distribution activities. Suppliers tend to handle in their warehouses and ship large quantities of relatively few items.[5] The basic unit handled by a manufacturer is a unit load of homogeneous product. Such a load is depicted in the far left of Figure 4.1. Since the shipping containers are of identical size and shape, they form a stable unit capable of being efficiently handled. Also, the unit load base is of standard size meaning that unit loads of different products can be effectively intermixed in warehouses or transport vehicles. In fact, the standard length and width of the unit load enables suppliers to effectively handle smaller quantities, such as one or several tiers of product.

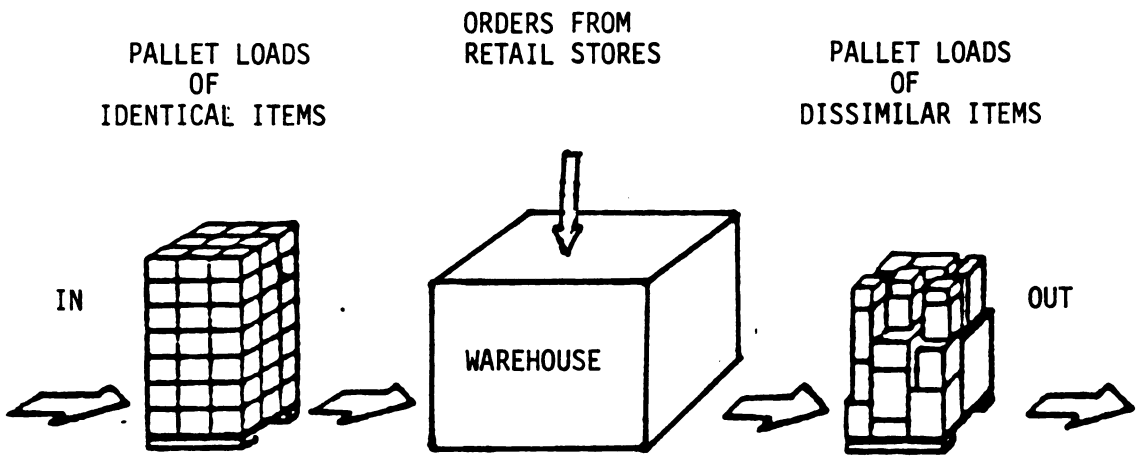

Figure 4.1 The Function of a Grocery Distribution Center

Source: Adopted from J. Francis Reintjes, An Exploratory Study of Possible Applications for Modern Technology in the Retail Food Industry, Massachusetts Institute of Technology Report ESL-PR-563, September 1974, p. 6.

The impact of shipping container size diversity is markedly different for food distributors. Distributors receive and store products in unit load quantities. However, since they ship orders to retail outlets consisting of relatively small quantities of thousands of different items, the basic unit of handling is the shipping container.[6] Small product quantities are shipped because only a very few products have turnover rates of greater than one case per week in the average store.[7,8] Orders are being delivered more frequently to stores as they attempt to eliminate backroom storage and place products directly onto the shelf.[9] Thus, the typical supermarket's order is made up of case-lot quantities of different suppliers' products. Figure 4.1 will be used to illustrate the implications of the quantity and product mix in store orders. The basic function of the warehouse is to receive homogeneous product loads from suppliers and assemble mixed loads for shipment to stores. The full impact of independent supplier package design decisions which lead to a profusion of shipping container sizes becomes apparent when the products are intermixed. Each supplier has designed its shipping container without consideration of how its shipping container relates to those of other suppliers. As a result, when the containers are intermixed for store orders, a wide range of disparate container sizes must be somehow combined into a unit load.

4.1.1 The Extent of Container Size Variety

The extent of shipping container size proliferation at the distributor level has been documented in several studies. A survey conducted by A.C. Nielsen in 1972 of a dry grocery distribution center stocking 5,000 items found 2,587 different sized[10] shipping containers.[11]

Analysis of the dry grocery case dimension data of a Michigan chain carrying 4,500 items in its distribution center revealed 122 different lengths, 114 different widths, and 97 different heights.[12] A supermarket chain recently did an in-depth study of the variation in container height in an average retail store order of 1,125 cases.[13] Containers' heights were measured and classified into half-inch categories. The distribution of case heights is presented in Table 4.1. The order had containers in every category and there were many different case heights within each category. In some instances, items with the same retail package dimensions and case pack were found in different shaped cases. The survey found that the canned goods category, considered by many to be more standardized, exhibited a wide variation in case height. Table 4.2 illustrates the variation in this category.

4.1.2 Implications of Case Size Variety

The effects of the plethora of shipping containers' sizes that exist fall into the areas of dampened productivity, increased product damage and loss, and wasted space in warehousing and transport of goods. Selection of retail store orders, which accounts for nearly 40 percent of warehouse labor,[14] is made more difficult by case size diversity. The assembly of the various sized cases into stable loads in which space is effectively utilized takes considerable time and skill. As a consequence, labor productivity suffers. Case size diversity has hindered productivity advances; by preventing the adoption of technology dependent upon some degree of container uniformity.[15,16] Second, the different sized cases cannot be effectively intermixed on the standard 48 by 40 inch pallet base, creating load instability, pallet overhang, and ultimately, product damage. Thirdly, intermixing the various cases

Table 4.1 Distribution of Case Heights in an Average Store Grocery Truckload*

Case Height Range (inches)	Number of Cases
3.0 - 3.5	42
3.5 - 4.0	76
4.0 - 4.5	67
4.5 - 5.0	68
5.0 - 5.5	54
5.5 - 6.0	59
6.0 - 6.5	41
6.5 - 7.0	59
7.0 - 7.5	96
7.5 - 8.0	66
8.0 - 8.5	68
8.5 - 9.0	53
9.0 - 9.5	87
9.5 - 10.0	58
10.0 - 10.5	54
10.5 - 11.0	44
11.0 - 11.5	26
11.5 - 12.0	32
12.0 - 12.5	11
12.5 and above	64

*1125 cases

Source: Dan Donegan, "Key Distribution Issues in the Food Industry," presentation to the GMA Joint Distribution Conference, Williamsburg, Virginia, September 1983.

Table 4.2 Distribution of Case Heights for Canned Goods in an Average Store Grocery Truckload*

Case Height Range (inches)	Number of Cases
3.0 - 3.5	14
3.5 - 4.0	5
4.0 - 4.5	18
4.5 - 5.0	20
5.0 - 5.5	7
5.5 - 6.0	9
6.0 - 6.5	9
6.5 - 7.0	2
7.0 - 7.5	32
7.5 - 8.0	7
8.0 - 8.5	2
8.5 - 9.0	6
9.0 - 9.5	54
9.5 - 10.0	16
10.0 - 10.5	2
10.5 -11.0	2

*205 cases

Source: Dan Donegan, "Key Distribution Issues in the Food Industry," presentation to the GMA Joint Distribution Conference, Williamsburg, Virginia, September 1983.

creates voids above a pallet causing wasted space in warehousing and shipment of products. In summary, the tremendous diversity in container dimensions implies that food distribution requires greater resources and is more costly.

4.2 A Modular Container System Defined

A change proposed to alleviate the problems caused by the multiplicity of container sizes is to standardize case dimensions to form a modular container system. The requirements of such a modular system, its origin, and current status are addressed in this section.

4.2.1 Requirements of a Modular Container System

Ideally, an overall or system-wide view of the physical distribution network should be employed to standardize shipping container dimensions. Such a perspective would integrate the size of transport carrier, unit load, shipping container, and possibly, retail package in a modular packaging system. In a modular system, the standard sizes of shipping containers would be a direct multiple of one another and the unit-load size in order to permit maximum flexibility in building mixed product loads.[17]

There are three basic requirements for a modular shipping container system. First, all case sizes must relate to at least one basic unit load size, such as a pallet. Second, container sizes are related to one another by standardized fractions of the unit load size so that various size containers can be mixed to create stable unit loads without wasted space. Third, the number of dimensional variations is limited in a modular container system.[18] A possible modular shipping container

system based on the standard U.S. grocery pallet and an actual modular system developed in Switzerland are presented in Tables 4.3 and 4.4, respectively.

4.2.2 Origin and History of the Modular Concept

The modular concept was originally developed and introduced in several countries in Western Europe.[19] The first application of the modular concept to food packaging occurred in Switzerland in 1964. The Federation of Migros Cooperatives, a grocers' association located in Zurich, developed a modular container system as a first step towards fully automated warehousing. The system consisted of 15 container sizes which were submodules of the standard European pallet of 80 by 120 centimeters. Table 4.4 illustrates the sizes possible and Figure 4.2 graphically depicts an example of a Migros unit load. The modularization program has proceeded on a voluntary basis and, by 1974, about 55 percent of the associations' total volume was in modular containers.[20] Benefits of the change cited by Migros officials include: 1) reduced damage due to more stable unit loads with no pallet overhang; 2) permitting greater warehouse and space utilization; and 3) enhanced opportunities to automate materials handling.[21] Standardization of containers has also permitted the use of more efficient handling techniques. Many high turnover items have been packaged in returnable modular crates or tote boxes.[22] The use of these containers is permitting the automatic selection and palletization of store orders for some products.[23]

Several Scandinavian countries have attempted to standardize packaging. In 1965, the Swedish Standardization Association began developing a system of voluntary standard modular sizes for shipping containers and consumer packages which were modules of the European pallet.[24] The

Table 4.3 A Modular Container System Based on the Standard U.S. Grocery Pallet

Length (Inches)	Fraction of 48 Inch Length	Width (Inches)	Fraction of 40 Inch Width	Height (Inches)	Fraction of 45 Inch Height
24	2	20	2	9	5
16	3	13.3	3	7.5	6
12	4	10	4	5.6	8
8	6	8	5	5	9
6	8	6.7	6	4.5	10
		5	8	3	15

Total Number of Container Sizes Possible in This Modular System: 180 (5 Lengths x 6 Widths x 6 Heights)

Source: A.D. Little, "An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution," report to the National Association of Food Chains, August 1974, p. F.1.

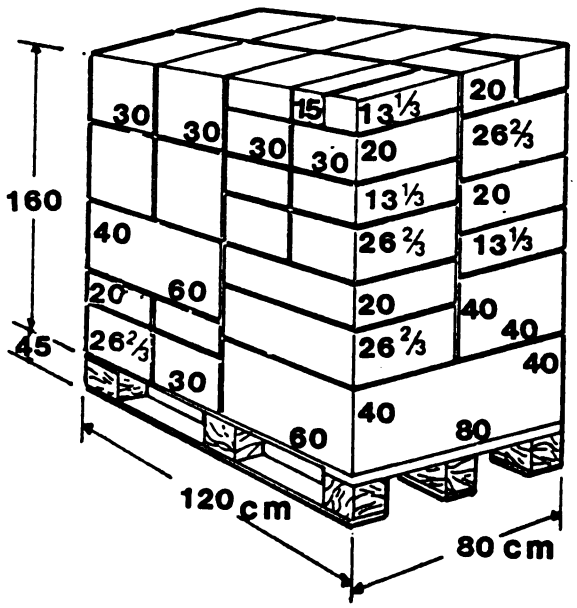

Figure 4.2 An Illustration of a Migros Unit Load of Modular Cases

Source: Dewayne E. Whitehead, "Modularized Packaging: Key to Distribution Savings," Food Engineering, March 1974, p. 85.

Table 4.4 The Migros Modular System in Switzerland*

Base Size	Length (cm.)		Width (cm.)		Height (cm.)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
80 x 60	76	80	58	60	95	100
60 x 40	58	60	38	40	12.5	13 1/3
40 x 40	38	40	38	40	19	20
40 x 30	38	40	29	30	25 2/3	26 2/3
40 x 26 2/3	38	40	25 1/3	26 2/3	39	40
40 x 15	38	40	14.5	15	51.8	53 1/3
30 x 20	29	30	19	20	78	80
					158	160

*The Migros system actually employs only 15 sizes out of the many possible in this system. The seven base sizes are coupled with some variations in height.

Source: A.D. Little, "An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution," report to the National Association of Food Chains, August 1974, p. 11.

idea behind the standardization effort was to simplify or rationalize the distribution of food products. This was done by reducing the number of handlings from the manufacturer to the retail store. This was accomplished through the use of smaller pallets (e.g., 80 x 60 cm. half pallets and 40 x 60 cm. quarter pallets which are submodules of the 80 x 120 European pallet) which are specifically designed to facilitate retail store delivery and store display. One of the first firms to implement the modular sizes was Tetra Pak of Lund, Sweden, which produces the Tetra Brik package for milk. The Tetra Brik has permitted automatic loading of packages into pallet modules. Individual packages need not be rehandled until the consumer purchases the product. Tetra Pak is the leading supplier of aseptic packaging and is now gaining popularity in the U.S. for juice and milk drinks.[27,28]

In 1968, the six leading grocery wholesalers in Sweden formed an organization called the ERFA group with the purpose of rationalizing the handling of goods through implementation of the Swedish Standards Institute's modular package sizes. The ERFA group has attempted to apply the modular concept from the producer and manufacturer all the way to the store shelves. Package designs are encouraged that permit the direct placement of shipping containers into standard sized retail shelves. This system produces savings in handling costs at the store level and maximizes the use of retail shelf space.[29] In 1978, about 1,000 items were in modular packages and about 15 percent of retailers had adopted modular shelves. Manufacturers and distributors were then beginning to realize cost savings.[30]

Some progress has been made in Holland on the standardization of food packaging. The Dutch Association of Chain Stores had studied

package-related distribution problems and initiated discussions with food manufacturers' representatives. In 1980, an agreement was reached on voluntary guidelines for the design of pallets, roll containers, secondary and primary packaging for new products.[31]

In the Netherlands, several developments have led to the establishment of voluntary standards for modular shipping packages. First, traditional power relationships between suppliers and distributors have been altered. In the past, suppliers concentrated their efforts on the product and the consumer and were able to dictate to the intermediate distributor trade.[32] The increases in concentration in the distributor sector have strengthened the bargaining position and challenged suppliers' dominance of the marketing channel.[33] Suppliers are being requested to design their products to better suit the needs of the retail trade rather than only the consumer. Packaging has been an important area of discussion. Specifically, many retail firms demand shipping packages which reduce distribution and in-store handling costs. Examples include shrink-wrapped trays and specified sizes of distribution and display units. A critical problem arose in that each retailer had different requirements and it would have been excessively costly for a manufacturer to comply with all of them. Consequently, in 1980, product suppliers were asking for greater discussion among retailers in order to develop a more common or uniform approach to shipping packaging changes.[34]

Retailers, wholesalers, manufacturers, and packagers in the Netherlands have formed a Foundation for the Realization of Standardized Distribution Packaging called Collomoduul. Collomoduul has investigated the efficiency of physical distribution of food and has found the

proliferation of distribution package sizes to be the major impediment to improved efficiency. A 1983 study of a distribution center carrying 3,000 items revealed 800 different distribution package types. The Foundation has concluded that this problem can only be solved through the adoption of standardized, mutually compatible package sizes.[35] Therefore, it has proposed recommendations for a modular series of distribution packaging (i.e., shipping containers), based upon the internationally standard pallet base of 100 x 120 cm. and the Dutch standard for roll containers of 60 x 80. A common module base of 40 x 60 cm. has been selected and a series of 12 shipping container sizes have been derived from it. Table 4.5 illustrates this modular container system. Container heights have not been recommended in order to allow manufacturers greater latitude in designing packages. The standardization program is voluntary and gradual implementation is expected as suppliers introduce new products or make changes in existing ones.[36]

4.3 Modularization in the United States

Modular shipping containers for dry grocery products have not been implemented in the U.S., although it has been the focus in countless interindustry discussions. However, the concept has been applied to fresh produce, and developments in that industry are briefly summarized below. Developments in the frozen food area are reviewed. Standardization of pallets and attempts to modularize shipping containers in the dry grocery segment of the food industry are then discussed.

4.3.1 Modularization in the Fresh Produce Industry

Physical distribution problems related to packaging have been very prominent in the fragmented fresh fruit and vegetable industry.

Table 4.5 Collomoduul's Modular Series of Distribution Packages for the Netherlands

Length (cm.)	Width (cm.)
40	60
20	60
10	60
30	40
20	40
15	40
10	40
20	30
10	30
15	20
10	20
10	15

Source: Sybolt A. ten Have, The Advantages of Modular Distribution Packaging, Amstelveen, The Netherlands: Collomoduul, June 1983, p. 7.

Individual growers, packers, and shippers have utilized traditional pallet and package types and sizes which are not suited for modern shipping methods. Many shippers have used pallet sizes or loading methods (e.g., lack of unitized loads and placement on pallets) which create difficulties in distributors' operations. Researchers have found a plethora of shipping container types and sizes, totaling 547 for 49 different commodities being used in produce shipment. Most containers were found to ineffectively utilize the surface of the standard 48 x 40 grocery pallet.[37]

The benefits of standardizing shipping containers were recognized over 30 years ago. For instance, one researcher stated in 1950 that:

> Standardization or simplification has been defined as reduction in industrial waste through the elimination of unnecessary sized, types, and dimensions of manufactured products. Consequently, as a consumer, the average citizen pays a large part of the ultimate aggregate costs of marketing fresh fruit and vegetables that are attributed to avoidable waste -- waste due to greater expense of manufacturing a large number of different sizes and types of containers; waste in the handling of odd-sized containers in transportation and in storage; and waste due to damage in transit and the distributive process.[38]

The United Fresh Fruit and Vegetable Association (UFFVA) took action toward achieving these benefits by initiating a program recommending greater standardization of pallet and container sizes and unitization of products. The 48 x 40 inch pallet was initially chosen as the standard pallet base.[39] In the late 1970s, the UFFVA incorporated modularization and metrication of sizes into its program and renamed it Project MUM for Modularization-Unitization-Metrication. In recognition of the growing importance of exports, the internationally standard metric size pallet of 120 x 100 cm. (47.3 x 39.4 inches) which approximates the 48 x 40 inch U.S. pallet was chosen as the produce industry standard 40. In

1981, the U.S. Department of Agriculture, working with the UFFVA, studied possible modular replacement containers and found that the hundreds of sizes currently used could be reduced to five metric sizes (lengths and widths) which are modular to the pallet base. Table 4.6 and Figure 4.3 illustrate the container sizes.[41] Trade practice recommendations for these sizes have been published and endorsed by the major distributor trade associations.

Despite projected benefits from reduced handling and damage, streamlined distribution, enhanced productivity, and fewer worker injuries, industry adoption of metric-modular containers has been sluggish.[42] A UFFVA representative has estimated the possible savings for the produce industry from Project MUM to be $750 million annually.[43] A supermarket chain calculated that modular containers would save $280,000 per year in its produce distribution operations.[44] However, these savings do not appear to provide sufficient incentives for implementation. A mere 1.2 percent of U.S. shippers used modular containers in 1982[45] and by 1984 this figure was still well below 5 percent.[46]

A major barrier to modular container adoption is that shippers would bear the cost of the change while distributors would reap the bulk of the savings. A shipper has stated: "we have captured about 90 percent of the cost savings at our end from Project MUM by shipping unitized loads on pallets," and added that the project is stalled because retailers, who will receive most of the benefits from modularization, have not pushed for the change.[47] A produce buyer for a leading retail chain shed some additional light on the adoption problem by separating the three components of Project MUM. Metrication was argued to be the concern of the shipper desiring to export, not the distributor.

Table 4.6 Project MUM Container Sizes

Length (cm.)	Width (cm.)
60	50
60	40
50	40
50	30
40	30

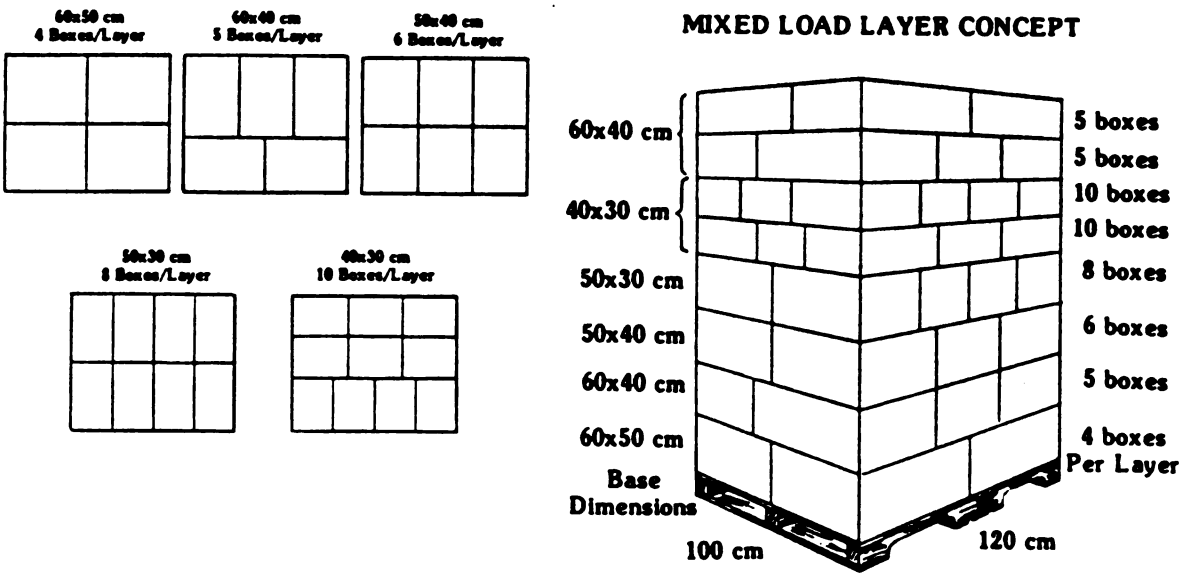

Figure 4.3 Illustration of a Load of Metric-Modular Containers

Source: Both Table and Figure were taken from United Fresh Fruit and Vegetable Association, Trade Practice Recommendations for the Fresh Fruit and Vegetable Industry, p. 4.

This buyer noted that modularization, which would be industry-wide, is an entirely different concept than unitization of one commodity; and that the chief beneficiaries of modularization are distributors in their assembly of products for store orders. However, a concern raised was that industry standardization efforts were paying insufficient attention to the depth (height) of containers. Standardization of container base dimensions would permit loads of shipper's homogeneous products to fit on standard pallets, but would not help retailers who ship mixed pallet loads to stores.[48] McLaughlin identified participants' dissatisfaction with recommended sizes as an obstacle to implementing Project MUM.[49] Specifically, distributors noted that since the height dimension was unspecified that mixed loads would be unstable. If these views about container height are widespread, it is possible that the distributor trade perceives that modularization has little to offer. This at least partly explains why distributors have not pressed for Project MUM containers. Expanding the program to include the height dimension could provide the necessary incentive for distributors to procure produce in Project MUM containers. A U.S. Department of Agriculture researcher notes this possibility in a UFFVA publication announcing an expansion in the number of recommended sizes from five to 14:

> In addition, the increased number of container sizes may allow a better chance of establishing fixed height for true modular loading and will provide more opportunities for receivers to mix container sizes within a layer on the 120 x 100 cm. base.[50]

While the container height is a critical factor in the distributor's warehouse operation, it is very difficult to standardize for fresh produce because container height is often related to the inherent nature of the product.[51]

One barrier to modularization in the fresh fruit and vegetable industry; the distribution of benefits and costs, has been briefly addressed in this section. The reader is referred to McLaughlin (1983)[52] for a more comprehensive treatment of this topic.

4.3.2 Modularization in the Frozen Food Industry

The topic of modular shipping containers has been studied only recently in the frozen food industry. The American Frozen Food Institute and the USDA - Agricultural Marketing Service began to jointly study modularization in 1982. The high cost of storage, transport, and display facilities is thought to make the frozen foods category an excellent candidate for modularization.[53] Investigations of a large regional chain's warehouse stocking 959 items revealed 542 different container sizes.[54] The research has found that the different frozen vegetable container sizes currently used could be replaced by 26 different sizes having fixed length, width, and height.[55]

4.3.3 Modularization in the Dry Grocery Segment of the Food Industry

The modular concept has been discussed at great length and has been studied on one occassion, but no attempts have been made toward implementation for dry grocery products. Background on this sector's efforts toward standardization of the unit load is presented in this section. The history of modularization is then traced.

A. Standardization of the Unit Load

Widespread use of forklift trucks during World War II led to recognition of the handling efficiencies associated with unitization (consolidation of smaller shipping packages into a larger unit). The first

unitizing method was the wooden pallet. Pallet sizes proliferated initially, and in 1959, the American National Standards Institute (ANSI) established the first national standards for pallets.[56] In the early 1960s, food industry interest in unit load handling increased and pallet exchange systems were brought into existence.[57] The grocery industry has attempted to adopt one of the ANSI recommended sizes of 48 x 40 inches as the standard grocery industry pallet. The Grocery Manufacturers of America (GMA) has developed pallet specifications which have been endorsed by major distributor trade groups. While most of the industry uses the GMA standard, other pallet sizes, most commonly the 42 x 35 inch size, can be found in use in the industry.[58]

The exchange of pallets has presented some challenges to the industry. Since pallets can be made of different wood types which deteriorate through use, the issue of pallet quality has been the key factor. Inferior quality pallets can be exchanged for pallets of higher quality leading to a breakdown of all participants' confidence in the system. A program certifying and enforcing pallet quality was advocated in order to make the pallet exchange system viable.[59] In 1973, an interindustry body, the Grocery Pallet Council (GPC), was established to insure the standard quality of pallets in the national pallet pool. Central to this effort was the creation of a branded pallet made possible by a copyrighted logo appearing on all GPC certified pallets. Guidelines were established for interchange, repair, and the determination of acceptable pallets.[60] The body's only legal authority was over the control of the use of the trademark. GPC membership and compliance with its guidelines were voluntary.[61] In the years following the program's inception, use of GPC pallets by wholesalers and retailers did not become widespread

and the program became defunct in 1978. The 1977 president of the GPC pointed to a shortsighted approach of some firms and a "to hell with the other guy" attitude, referring to the practice of trading poor pallets for good ones as reasons for the program's demise.[62]

The size of pallets and unit loads are entangled with the issue of container modularization. The reason for this is that while a standard pallet size has been agreed upon, the size of the unit load has not. Thus, manufacturers can and do design unit loads which do not exactly fit on the standard base. This results in either pallet "underhang" or "overhang."[63] For example, a supplier of lightweight products may overdesign its unit load in order to better utilize transport vehicle space. As a result, there is less damage through better shock absorption and reduced load shifting.[64] An underlying reason why a supplier's products can extend over pallets by up to six and eight inches is that the standard 48 x 40 inch pallet does not precisely fit on truck trailers which have been restricted to 96 inches by federal law.[65]

Pallet overhang can reduce suppliers' transportation costs, but it adds a substantial cost burden to distributors in the form of damage and wasted space. Pallet overhang has been identified as a major factor contributing to product damage and losses.[66,67] Pallet overhang is also considered to be a serious constraint on the successful operation of more automated systems.[68,69]

As noted in Section 4.2.1, one requirement of a modular container system is that container sizes be related in a fashion so that they fit precisely onto the unit load base. Implementation of modular containers would thus, in effect, require suppliers to design unit loads with no or little overhang. The standardization of unit load dimensions to fit the

48 x 40 inch pallet made possible through modularization would provide benefits to distributors, but would ultimately increase suppliers' transportation expenses. Thus, while it first appeared that a modularization could be developed around a standard module, in fact, a modularization program would involve the standardization of the unit loads to fit the 48 x 40 inch pallet. This undertaking alone would be monumental given the skewed benefit-cost distribution between the supplier and distributor industries.

B. Modularization of Shipping Containers

The topic of modularization received much discussion and some study in the early 1970s, but this interest dwindled thereafter. Some innovative industry leaders, particularly Gordon Bloom of the Massachusetts Institute of Technology, employed a "systems" approach which identified wasteful industry practices and suggested ways that the various stages could be integrated into a more efficient system. Physical distribution, which spans numerous functional and structural lines of authority, was found to be an area particularly ripe for improvement.[70] The standardization of shipping containers was proposed as a way to streamline the food distribution pipeline, thereby improving productivity and lowering food prices. The efforts of several Western European countries at standardizing shipping containers into a modular packaging system brought the modular concept to the attention of many food industry researchers and leaders.

Interest in modularization led to both the formation of an inter-industry task force to study the feasibility of modularization,[71] and to the initiation of such a study in 1973 by the National Association of Food Chains (NAFC).[72] The pilot study, financed solely by the NAFC,

was conducted by the consulting firm of A.D. Little, Inc. An interindustry advisory group consisting of representatives of the Grocery Manufacturers of America (GMA), other distributor trade associations, and supplier and distributor firms guided the project. The report focused primarily on the effects of modularization on the wholesale-retail distribution center and found significant potential savings in the areas of damage, warehouse labor, and transportation to stores. Chapter 5 presents A.D. Little's results in greater detail. After the project's completion in 1974, NAFC planned to form an interindustry committee patterned after the Universal Product Code's implementation mechanism in order to move the modular concept toward implementation.[73]

Implementation of modularization fell far short of expectations primarily due to manufacturer resistance. The response of the GMA to the A.D. Little study was to undertake their own study of implementation costs which was not published. According to the trade press, the NAFC was given an outright rejection to any movement toward modularization or even a compromise proposal to consider modularization when and if conversion to the metric system occurred in the U.S. The NAFC backed away from its initial drive to implement a complete modularization program and attempted to define some areas of mutual interest with GMA in order that some packaging improvements could be made. An interindustry task force was formed to study improvements and develop recommendations. In 1975, the committee made three suggestions relating to product damage. It called for the elimination of bags and bales, strengthening of containers, reduction of pallet overhang to within a one-inch limit, and for further study of the total systems cost of product damage.[74] An interim committee made up of supplier and distributor representatives

was created in 1976 to define packaging problems and suggest directions for improvements.[75] This committee apparently made little progress since almost two years later, the chairman of the committee was planning an independent distributor study on the magnitude and incidence of damage due to faulty packaging.[76]

Distributors' strategy to work with manufacturers on specific problem areas, such as pallet overhang and container strength, rather than a full modular packaging system appears to have been largely ineffective. In the opinion of some industry observers, manufacturers' resistance to a number of industry-wide changes, including modular packaging, was the beginning of a gradual deterioration in supplier-distributor relations which culminated in a divisive confrontation over legislation to legalize cost-justified backhaul. Several industry relations conferences have been instrumental in bringing the two parties closer together since then. Cooperative research projects have been undertaken on coupon handling costs, a universal communication system (UCS) permitting computer-to-computer ordering, and most recently, shipping container design. Supplier support of the shipping container study has been called "...a complete turnaround from what manufacturers felt less than a decade ago when they refused to discuss anything related to a revision of secondary packaging."[77]

The joint industry project is a feasibility study exploring ways to enhance physical distribution efficiency through improving shipping container design. The study is envisioned as the beginning of a two-step process. The project's aim is to provide a blueprint that identifies issues and priorities and to make recommendations for shipping container improvements.[78] At that point, the interindustry task force overseeing

the study may choose to initiate further studies to develop implementation plans for selected container design improvements.[79] The two-step nature of the feasibility study approach has been found valuable in obtaining the necessary supplier-distributor cooperation for such projects, according to FMI President Robert Aders.[80] The shipping container project has been hired out to the A.T. Kearney consulting firm in March of 1984. At that time, none of the project sponsors would discuss whether modularization would be studied.[81]

Examining the language of project documents sheds some light on the extent to which modular packaging may be studied. For example, the FMI-GMA RFP contains the following provision concerning recommendations for generic shipping container design guidelines:

> These guidelines may recommend changes in the physical characteristics of shipping containers and/or their sizes. In order to allow for marketing latitude, all recommendations regarding size should take the form of acceptable ranges rather than rigid size standardization.[82]

If a modularization program is equated with "rigid size standardization," then it would appear that modular container sizes cannot be recommended by the study.

The Kearney proposal contains language with possible implications for modularization. In defining the project's work scope, Kearney indicates it will: 1) identify opportunities for greater physical distribution efficiency through shipping container design improvements; and 2) evaluate the technical, marketing, and economic feasibility of such changes. With regard to assessing marketing feasibility, their proposal states:

> We will specifically exclude from consideration any changes in shipping container design that would require a change in consumer or primary product packaging. This would, in our view,

> be an incursion on the marketing flexibility. We will, however, assess the extent to which existing (primary and secondary combinations) can be improved through shipping container design, for example, revised item counts.[83]

Thus, modular packaging could be initially studied as an opportunity to improve distribution efficiency. However, it is uncertain whether modularization would receive a more in-depth study because of the feasibility criterion for recommended changes. The issue appears to hinge on whether modularization would impact retail packaging. If modularization necessitates altering retail packages, then it would be screened from further analysis because of infeasibility from a marketing standpoint. However, a modular program which leaves retail packaging intact could conceivably be given in-depth study and be recommended as a generic guideline for shipping container design.

A report summarizing the first of the project's three phases was made public in December 1984. Objectives of the first phase were to: 1) identify opportunities for improvement in shipping container design; 2) assess the approximate magnitude of benefits for distributors only; 3) identify barriers which impact change; and 4) recommend actions for Phase II.[84] An industry-wide survey that yielded responses from 31 manufacturers and 55 distributors and interviews with nine distributors led to the identification of 29 shipping container improvements.[85] Benefits for each improvement were estimated for the largest of three categories: warehouse labor productivity, space utilization, and damage reduction.[86] Opportunities that were found to have the greatest savings potential were package standardization and increasing the strength of bags.[87]

Kearney's selection of improvements for further study in Phase II was largely based on the factors of: 1) the magnitude of benefits

obtainable through piecemeal implementation; 2) the feasibility of implementation. For example, they state:

> In the final analysis, the key issue became identification of what realistic improvements could be expected from implementation, rather than theoretical improvements which are less likely to be realized.[88]

Consequently, Kearney concluded that the best place to start in the second study phase was the improvements with substantial savings that impacted relatively few containers.[89] Standardization, which offered the greatest savings ($116 million), but would impact most containers, was not selected. However, it was categorized as the improvement having the best long-term potential. Kearney did select the following standardization option with lower savings ($14.2 million):

> Standardization of the shipping containers for products with the same retail pack would yield benefits similar to the modularization concept, reducing damage, and increasing load stability. Approximately 1.3 billion cases are impacted and include 303 cans, baby foods, and gelatins, and represent approximately 10 percent of total dry grocery products.[90]

Thus, it appears that a complete modular program which affects retail packaging will not be further investigated in the joint industry project. However, the "partial modularization" step described above will be analyzed, and since few cases are impacted and marketing resistance associated with altering retail packages should be eliminated, it may be implemented. Thus, it could serve as an initial step to achieving the more substantial savings of a full modular program.

One other improvement slated for further investigation is increasing the strength of bags. Only 5 percent of the total dry grocery case volume are bagged packages, yet this category represents 34 percent of total damage.[91] In addition to affecting a relatively small percentage

of case volume, improving bag strength offered savings ($64 million) second only to a shipping container standardization.[92] The study is expected to be completed by mid 1985. Kearney's results are discussed in greater detail in Section 5.2.1

4.4 Chapter Summary

Shipping container size proliferation was shown to be an interindustry problem. Independent manufacturer decisions based on their individual product's physical and marketing requirements leads to a proliferation of retail package and, consequently, shipping container sizes. The effects of manufacturers' decisions surface at the distributor level where relatively small quantities of thousands of products are handled. Shipping container proliferation raises distributors' costs by reducing warehouse labor productivity, causing damage, and ineffectively using space in warehousing and transport.

A "system-wide" solution to the interindustry problem, modular packaging, was defined. Its origin and development in several Western European countries is described. Developments in three major segments of the U.S. food industry are traced. The fresh produce industry has progressed further in the development of specific modular sizes and trade association implementation programs. Still, adoption has been very slow and only a minute percentage of firms use modular sizes. In the frozen food industry, joint government-manufacturer research efforts have only recently been initiated.

Standardization efforts in the dry grocery segment of the food industry were described. A review of industry efforts beginning in the 1950s to standardize the unit load was found to be only partially

successful since manufacturers' unit loads commonly extend over the standard pallet base. Pallet "overhang" reduces productivity and creates damage in distributor's operations. Modularization of shipping containers first received attention in the late 1960s and culminated in a distributor sponsored study in 1974. After the project's completion, plans for implementation stalled, according to trade observers, because of manufacturer resistance. Subsequent distributor efforts focused on smaller specific issues such as product damage, but were largely ineffective.

A significant recent development is the joint industry study of improvements in shipping container design. A review of project documents indicated that a modularization could be initially studied. However, any modularization program which affected manufacturers' marketing flexibility by impacting retail packaging would be screened from further analysis and as a study recommendation. Results of the first phase support the above statement. Package standardization was estimated to have the greatest savings potential of 29 container improvements; it was not selected for further analysis. However, a "partial" standardization option which would not affect retail packaging will receive further in-depth study. The joint industry project is expected to be completed in mid 1985.

CHAPTER 4

FOOTNOTES

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[86]Ibid., p. III.4.

[87]Ibid., p. IV.8.

[88]Ibid., pp. V.1-V.2.

[89]Ibid., p. V.2.

[90]Ibid., pp. V.3-V.4.

[91]Ibid., p. V.4.

[92]Ibid., p. IV.8.

CHAPTER 5

THE PROBABLE EFFECTS OF A MODULAR CONTAINER SYSTEM

This chapter's purpose is to outline the impacts of implementing modular packaging on food system participants and review the evidence of these impacts. The term "probable" inserted into the title of this chapter should alert the reader that some uncertainty surrounds these effects. This uncertainty results primarily from the lack of specificity of a modular package system. Modularization is presently a hypothetical concept being considered for application to the U.S. Food industry and decisions have not yet been made about the number of specific modular sizes.[1] Until these sizes are specified, the full ramifications of modular packaging will be difficult to precisely predict. For example, the number of sizes and particular sizes selected influence whether and to what degree retail packaging will need modification. Recognizing this difficulty, the following discussion attempts to describe the general direction, rather than precise level of impact, of the effects of implementing modular packaging.

5.1 Conceptualizing the Effects of Modularization

The effects of modular packaging are addressed in this section by: 1) delineating the major food system participants affected; 2) building a simple conceptual model of the benefits and costs of modularization.

5.1.1 Food System Participants Affected by Modularization

Implementation of modular packaging in the complex U.S. food system would have far-reaching impacts. While not totally inclusive, Figure 5.1 presents the major parties likely to be impacted by a modularization program. Of all the parties identified, modularization would most dramatically impact food manufacturers, food distributors (wholesalers and retailers) and consumers.

5.1.2 A Simple Model of Benefits and Costs

Figure 5.2 illustrates a model of the benefits and costs of modular packaging. The simplified food delivery "pipeline" depicts manufacturers, distributors and consumers. The focus of the model is on total system efficiency, rather than on the efficiency of a particular stage in the distribution chain. If the food pipeline can be streamlined, valuable resources can be saved and food marketing costs can be lowered, possibly leading to lower food prices to consumers. The "systems" perspective is essential since changes are possible which could reduce overall costs but involve higher costs for one stage. A classic example is the Universal Product Code (UPC) symbol. Manufacturers incurred costs by affixing UPC labels to their retail packages and received no direct benefits. Retailers, on the other hand, have received benefits in their store operations in excess of the investment in scanning equipment. Total industry-wide net benefits were calculated to be positive in the pioneer studies of the UPC.[2] Modular packaging, another innovation proposed to reduce overall costs, has a similar disproportionate benefit and cost incidence. In general, the brunt of implementing modular packaging would be borne by manufacturers while the majority of benefits will go to distributors.

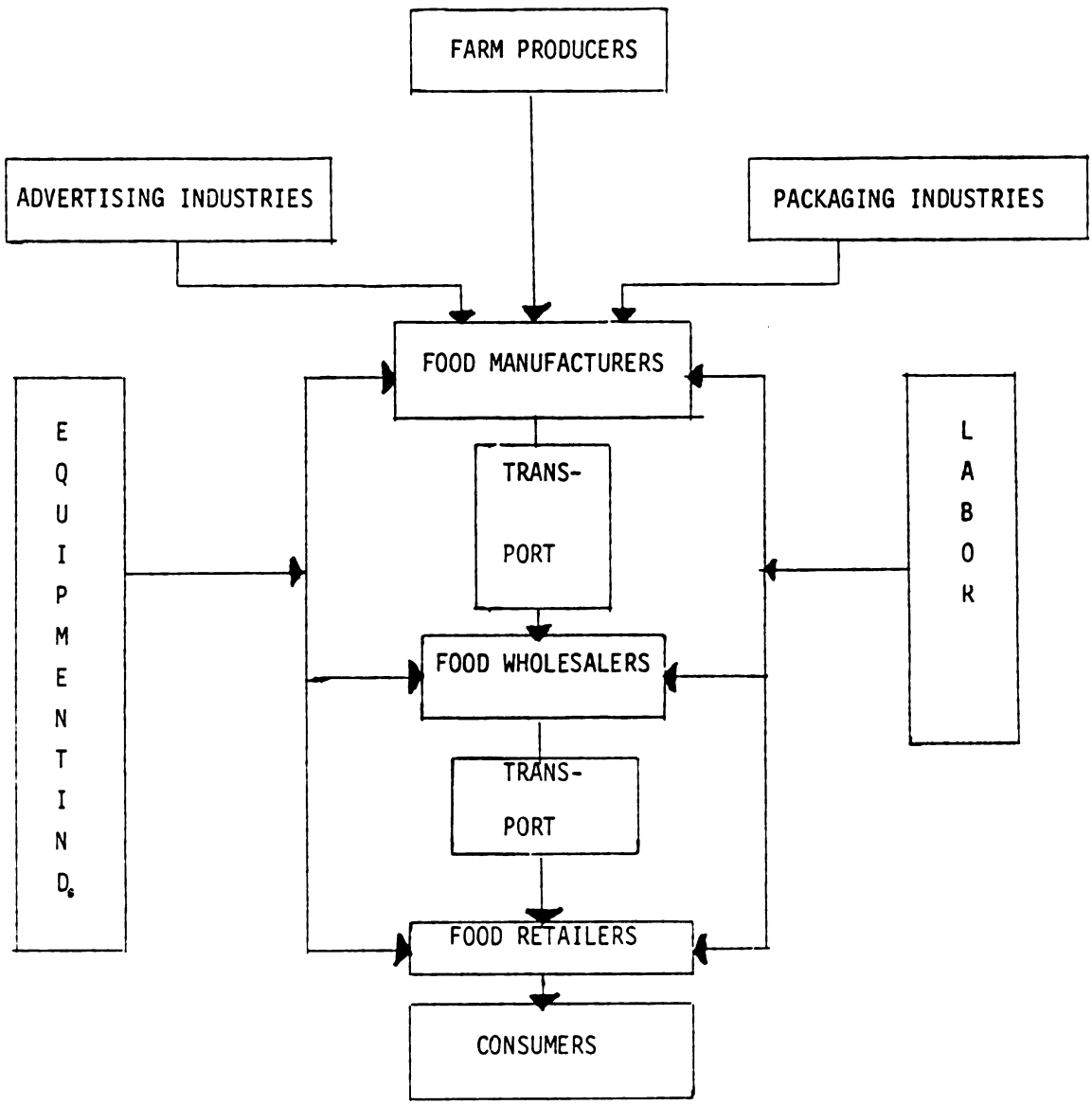
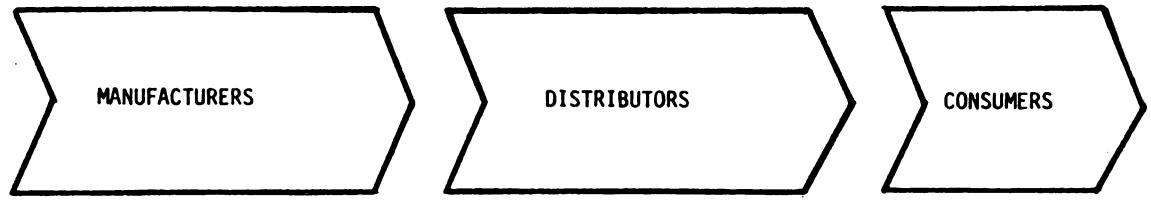


Figure 5.1 Participants Affected by Modularization



IMPACT TYPE	MANUFACTURERS	DISTRIBUTORS	CONSUMERS
PHYSICAL IMPACTS:			
FIRST ROUND			
COSTS	EQUIPMENT ADJUSTMENT/REPLACEMENT	NONE (IF UNIT LOAD STAYS THE SAME)	
SAVINGS	SIMPLIFICATION IN PACKAGING AND DISTRIBUTION	INCREASED PRODUCTIVITY IN WAREHOUSE TRANSPORTATION AND RETAIL LEVEL	
NET EFFECT	?	PROBABLY POSITIVE	
SECOND ROUND			
COSTS	INVESTMENT IN NEW EQUIPMENT AND METHODS FOR MODULAR CASE SIZES	INVESTMENT IN NEW EQUIPMENT AND METHODS FOR MODULAR CASE SIZES	
SAVINGS	SAVINGS FROM USING NEW EQUIPMENT AND METHODS	SAVINGS IN WAREHOUSING AND RETAILING	
NET EFFECT	?	?	
TOTAL PHYSICAL IMPACTS	?	PROBABLY POSITIVE	LOWER FOOD PRICES (IF SAVINGS ARE PASSED ON)
MARKETING EFFECTS:			
COSTS	UNCERTAIN - DEPENDS ON THE DEGREE OF RETAIL PACKAGE SIZE IMPACT	UNCERTAIN	
BENEFITS	POTENTIAL EASIER BUILDING OF OF DISPLAYS OF DIFFERENT PRODUCTS	POTENTIAL INCREASED UTILIZATION OF RETAIL SHELF SPACE	
NET EFFECT	?	PROBABLY POSITIVE	UNCERTAIN
TOTAL	?	PROBABLY POSITIVE	UNCERTAIN

Figure 5.2 A Simple Model of Modularization Benefits and Costs

However, an important difference between UPC and modularization should be noted. Manufacturers incurred costs and gained nothing directly from UPC. In the case of modularization, manufacturers would incur costs in converting to modular sizes but would also benefit from fewer sizes since standardization should reduce costs in manufacturer operations through greater simplification. The categories of modularization impact for manufacturers and distributors are outlined in Figure 5.2 and are elaborated upon below. Potential effects on consumers are then discussed.

A note of caution is necessary before proceeding. Modularization is at present a concept being considered for application in the U.S. physical distribution system for dry groceries. The number of modular sizes and the specific sizes have not been worked out. In the trade literature food-industry participants have stated that as few as 10 and as many as 300 sizes would exist in a modular system. The lack of specificity in how modularization would be operationalized limits our ability to predict the effects of modularization. Thus, the general direction of probable impacts will be emphasized.

A. Manufacturers

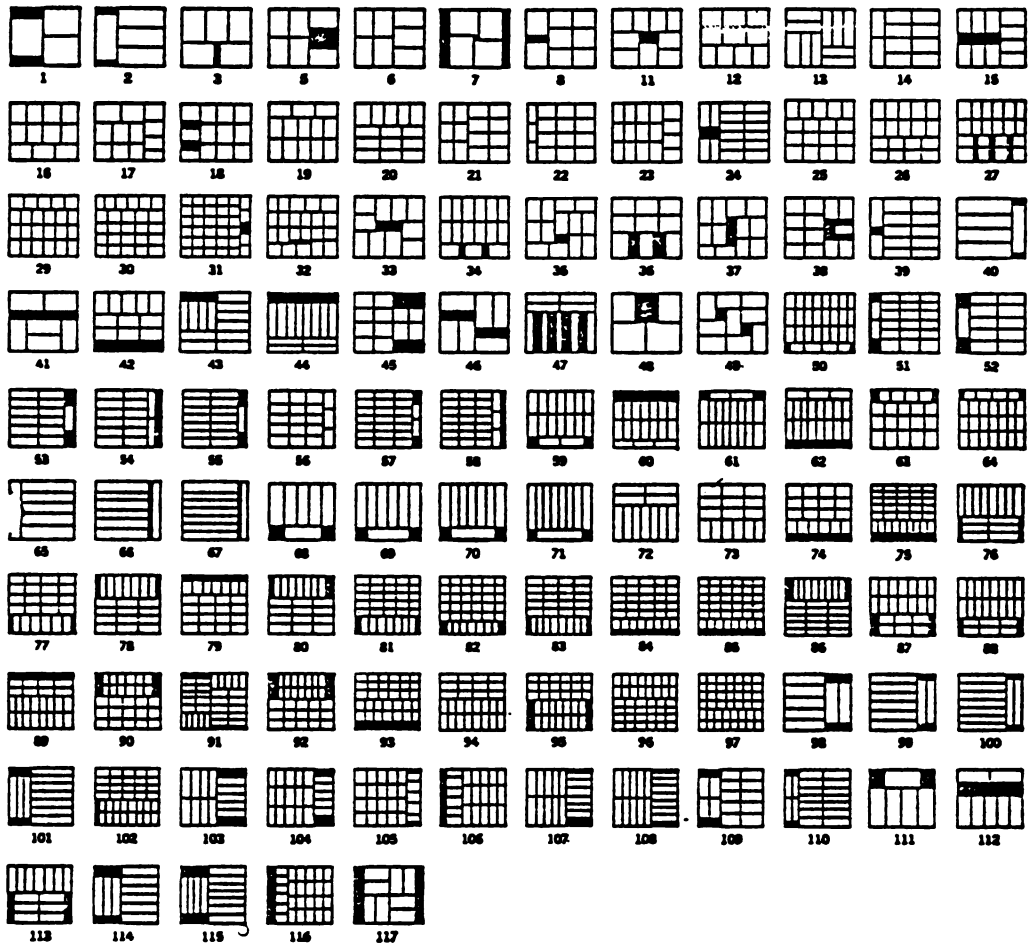
The initial first-round effect of any modularization program will be the costs of changing equipment and procedures at the manufacturing level. The magnitude of these costs will depend upon the modular sizes chosen. If the modular container system has enough sizes so that existing retail package sizes need not be changed (e.g. only their number or configuration in a case), manufacturers will need only to change secondary (shipping container) packaging equipment. Since this equipment is in general quite flexible, costs of the change would be low. On the other hand, if the modular system chosen requires adjustment to retail package

sizes, modularization conversion costs will be higher. This is because primary package equipment is less flexible than secondary equipment. It is also possible the necessary retail package change might not be possible on existing machinery, which would mean the high expense of equipment replacement. Along with any change in retail packages would come a number of marketing/consumer impacts, which will be discussed shortly.

A second type of first-round physical impact of modularization for manufacturers would be possible cost savings through efficiencies achieved through greater simplification. For example, reduced inventories of shipping containers may be needed because of the reduction in the number of sizes. A second example is potential improvement in space utilization in warehousing and transportation through more effective use of the cubic area on a pallet. Not all unit loads of product utilize available pallet space such as the one in Figure 4.3. Numerous configurations of cases on a layer (pallet patterns) have been devised to accomodate the wide range of case sizes which exist. Exhibit 5.1 presents a guide to selecting appropriate patterns for arranging containers given a shipping container's length and width. Close examination of the figure reveals that only 22 of 117 patterns use available cubic space. The remainder have voids within them or "underhang" the pallet base. This translates into ineffective space use in warehousing and transit and, ultimately, into higher costs for manufacturers. Conversion to modular packaging, which requires all cases to be modules of the pallet base, would reduce or eliminate this wasted space. This gain in space use would have to be compared against any loss in cube that occured due to

Pallet pattern guide

(for 40" x 48" pallets)



How to Use This Guide:

With this guide you can determine the most efficient interlocking patterns for 40" x 48" pallets with an allowable overhang to 43" x 52". It will also help you to select the most efficient container shape (length and width) for palletizing. Container dimensions vary from 5 inches to 21½ inches in width and from 6½ inches to 43 inches in length, in ½-inch increments.

To determine best pallet pattern, find container width in inches along top of charts on pages A/135, A/136, A/137. Read down either side to find length. Read across to width column and find pattern number. Where more than one pattern is shown, listing is in decreasing area efficiency. Use top number wherever possible. Where no pattern is listed, area efficiency is below 80%.

*This guide was prepared from a Container Selection Slide Rule released by the U.S. Naval Supply Research & Development Facility, Bayonne, N.J.

Exhibit 5.1 A Pallet Pattern Guide Used by Grocery Manufacturers

the elimination of pallet "overhang" by modularization to see if manufacturers' costs will be reduced.

A modular program which affects retail packages could provide opportunities for productivity enhancement through simplification once the initial adjustment costs were made. For instance, fewer retail package sizes would reduce inventory costs since fewer sizes need be on hand. Also, equipment utilization would be enhanced since the frequency of stopping packaging machinery to change over to new sizes would be reduced.

The modularization of shipping containers could conceivably produce a second-round of physical impacts. These effects are categorized as second-round since they are the result of changes in methods of equipment made possible by standardization. For example, with more standard case dimensions and pallet patterns, more manufacturers should be able to utilize automatic palletizing equipment thereby saving labor costs. Others may be able to use less expensive simplified equipment. Standardized pallet load dimensions should allow manufacturers to build smaller warehouses since cube utilization will be improved. They may also be able to invest in more automated warehousing systems.

The total physical effects for manufacturers of modularization upon manufacturers would be a sum of the net first- and second-round impacts in Figure 5.2. An important question is: if these total impacts of standardization of case sizes is a positive dollar amount, then why don't manufacturers act to capture these savings? One case example where a manufacturer has reduced the number of package sizes is presented in Chapter 6. For the most part, suppliers have not standardized the case sizes used within their firm. This would seem to indicate that the total effects box in Figure 5.2 is a negative dollar amount or that

there are additional factors which enter into firm decision making. The missing category of factors is that of marketing.

The general category of marketing impacts includes factors relating to providing the right product in the correct portion, and with the appropriate convenience features (including packaging) that consumers' desire. Each food manufacturer attempts to design a product that best attracts consumers to purchase its product. Suppliers also attempt to influence consumer preferences through marketing, advertising and promotion techniques. A central part of this strategy is to create a brand product that has an image which is distinctive from other products. Retail packaging plays a key role in that image in advertisements, on the retail shelf, and in the consumers' home.

Modularization could have an impact on these marketing activities in two ways. First, if a modularization program necessitates changing the count of retail packages per container, some suppliers may be put at a competitive disadvantage. A manufacturer with a smaller case pack than a competitor would run a greater risk of its product being out of stock. On the other hand, a supplier with a larger count in a product category would have a greater price per case. A buyer that compared case cost, not per item cost, would perceive that manufacturers product as more expensive than it actually was. The result could be lower sales for the supplier. However, other manufacturers with a reduced count would have the opposite effect possibly increasing their sales.

Second, modular packaging could yield marketing impacts if retail package sizes are affected. Such standardization could limit suppliers' marketing flexibility and possibly change the nature of competition in the grocery business. Greater similarity in size across a product

category might reduce the ability of one supplier to differentiate its product from another, perhaps leading to consumer product comparisons on more of a price basis. However, for products having different densities, retail package size standardization could result in greater variation in quantities and net weight of products, thereby making consumer value comparisons more difficult. For products of similar densities, this would not be a problem and it is possible that consumers would make better value comparisons among products, thereby shifting competition from non-price to price attributes. This competition could drive down prices and reduce suppliers' profitability.

A modularization program may also produce some marketing benefits to suppliers. For instance, a reduced number of case sizes will allow a greater degree of intermixing of supplier products on a unit load. Thus, a display of various products to fit a particular retail store's needs could be constructed and delivered at lower cost by either reduced handling in distributors' warehouses or by passing the warehouse with delivery direct to stores. One caveat to this marketing advantage is worth mentioning. Some suppliers currently deliver whole pallet or loads consisting of mixed tiers of items to distributors for retail display. In addition to reduced costs, this practice has the marketing advantage of obtaining a larger amount of valuable retail shelf space. Modularization would reduce this marketing advantage since more products could be intermixed in smaller amounts on a pallet display.

B. Distributors

The effects of modularization on distributors are related directly to shipping container size standardization. Thus, the general direction of impacts of reducing the number of case sizes to form a modular system

can be inferred without knowing the number of and particular modular sizes.

The first-round impacts of modularization should not involve any direct costs to distributors provided that the unit load base remains at 48 by 40 inches. It is very unlikely that the unit load base would be modified in any modularization program because of extensive industry efforts spanning several decades in standardizing to this pallet size. However, if the base were changed, then distributors would face major costs in redesigning their internal warehouse layout and racking.

There are a number of first-round modularization impacts which are benefits for distributors. First, the precise fitting of unit loads on pallets (elimination of overhang) should allow distributors to handle products with greater ease in the narrow confines of truck trailers, warehouse aisles and racks. Manufacturers' loads would have greater stability with more product in a load. Thus, greater handling productivity would be possible.

The fundamental advantage of modularization occurs when case-lot quantities of different manufacturers' products are merged in the retail order selection and delivery process. Labor productivity in the load assembly operation in manual and mechanized/automated systems would increase. In addition, the mixed loads should be more stable and they should fit more precisely on the pallet base, thereby reducing damage in the warehouse, in transit, and at the retail store level.

Modular containers, which are designed to fit with one another, would increase the utilization of space in a mixed pallet load assembled for retail delivery. Expanded pallet load cube use translates into reduced space requirements at the warehouse and retail level, and the

potential for carrying a greater amount of product in transportation vehicles. Realizing savings in transportation would be subject to the amount of additional weight a truck trailer could handle before weight limits were reached.

A final area of possible savings is the increased productivity of automated and mechanized equipment. Currently, unusual container shapes and sizes create difficulties in the lanes and conveyors of automated/ mechanized systems. These containers may cause tie ups resulting in damage that causes the entire system to be shut down. Often unusual sizes or types have to be removed from the equipment and handled manually. Thus, modularization should enhance productivity by: 1) permitting smoother uninterrupted functioning of equipment; and 2) permitting a greater proportion of products to flow through the automated or mechanized operation.

The second-round of physical impacts would include new practices and equipment that would be possible with the advent of modular packaging. Some of these would require little investment and others would require substantial outlay before benefits would be realized.

The training of new workers to select and assemble orders for retail stores would be a benefit area that would require only minor investment in new training methods. Order pickers should learn how to assemble modular containers into stable unit loads with minimal wasted space much faster than with the current plethora of container sizes.

Modularization will enable distributors to implement more sophisticated automated, mechanized and possibly robotics technology in their warehousing operations. The benefits to distributors, after netting out investment costs, are likely to be greater productivity and labor cost

savings. Although technology could be applied at many points in the warehousing system with uniform sizes, an area particularly ripe for improvement in existing automated facilities is the manual load assembly operation. With fewer case sizes, automatic palletizing equipment could be used to assemble store orders thereby improving productivity of that activity and possibly the overall warehouse system. The modularization of shipping containers could provide the incentive for development and application of "blue sky" innovations which could greatly expand productivity and lower warehousing costs.

The industry-wide adoption of modular packaging could impact the retail store level. One area that might be affected is shelf display. Supermarket shelving could be redesigned and standardized to accept modular sizes. More product could be displayed in the same amount of area. If this were possible, a greater number of products could be added to the store's offerings or, alternatively, smaller less costly supermarkets could be built.

C. Consumers

Impacts upon consumers need to be considered at two levels. First, if only the shipping container, not the retail package, is altered, then few direct impacts are expected. One possible effect concerns case pack change. Modularization could change the item count per case. A possible effect is that a product a consumer desires would be out of stock more often compared to present case packs. However, it is also possible that item count revision could mean more of a particular product being available on a retail store shelf. It is difficult to say a priori what the effect would be for a product.

Consumers would be impacted by shipping container modularization through the prices they pay for food. The effect may be positive or negative depending upon the level of competition at different industry stages. As noted, a first-round effect of modularization on manufacturers is increased costs from equipment conversion. In a largely oligopolistic industry, firms would be able to pass on these costs by increasing their prices to distributors. The outcome for the consumer depends upon: 1) whether savings to distributors exceed higher manufacturers' prices; and 2) level of competition which forces distributors to pass on any net savings.

If the increase in prices charged to distributors exceed savings from modular containers, distributors' costs will have increased. Thus the only possible outcome is higher prices to consumers. The amount of increase will depend upon whether the gross savings to distributors which are passed on to consumers partially offset the increase in manufacturers' product prices. Consumer price increases will be greatest if distributors pass the full manufacturer upcharge to the consumer. To the extent that competition forces distributors to pass the savings which accrue to them from modularization on to consumers, the amount of the price increase to consumers will be reduced. It should be noted that distributors, if they have sufficient market power to pass all manufacturers' price increases forward, can improve their profitability even in the case of an innovation which has no net system savings.

In the case where modularization produces net system savings, three outcomes can occur depending on the degree of competition in the distributor industry. First, if competition is intense, distributors will be forced to pass on all or most of their savings thereby reducing consumer

prices. Second, if distributors pass on only enough of their savings to just offset the increases in manufacturers' product prices, consumer prices will be unchanged. Third, if distributors possess substantial market power, so that they can retain cost savings and pass manufacturer price increases forward, consumer prices would be higher.

A second level of consumer impacts will result if retail packages change with modularization. For example, a new retail package size may contain a portion of product that is preferred less to presently available portions. If the portion is larger than desired, the consumer will have paid for a product that is of less value to them. Also, the new package may have different convenience features which makes the product less easy to store and use. Alternatively, the revised package may simply have an appearance that is less appealing than the former size.

5.1.3 Benefit and Cost Incidence: Existence of Incentives for Implementation

The focus of the model developed in the previous section was on total system costs. It was suggested in that modular packaging possibly could reduce overall system costs even though higher costs might be incurred at the manufacturing level. While manufacturers may realize some savings from modularization, they would bear the cost of change. Distributors would receive substantial benefits from the change. If benefits to distributors are in excess of the costs to manufacturers, then the following question is critical: Can distributors use some of their modularization savings to compensate suppliers for their conversion costs and still remain better off? In other terms, could the winners compensate the losers for their losses and end up in an improved position (a pareto better change through exchange). For such a transaction to take

place, at least two things are necessary: 1) information on the value of the "good" being exchanged is needed; and 2) an institutional mechanism, such as a market or political forum, must exist for the transaction. The next section reviews evidence on the effects of modularization and estimates of the value of these effects.

5.2 A Brief Review of the Evidence

Evidence of the effects of modular packaging outlined above is reviewed. The types of evidence are: 1) original empirical work; 2) surveys which have attempted to quantify participants' views of the impacts; 3) qualitative assessments of impact by knowledgable persons in different food industry sectors; and 4) quantitative assessments by individuals.

5.2.1 Original Empirical Work

The only area of modularization impacts which has been studied empirically is that of distributor benefits. Thus, data only exists for two categories, distributor first- and second-round physical impacts, in Figure 5.2. This research has been confined primarily to the warehouse and transportation functions of the retail store distributor. The three existing studies are: 1) the first phase completed in December, 1984 of a joint industry sponsored project being conducted by A.T. Kearney; 2) a 1974 retail chain trade association sponsored study conducted by A. D. Little; and 3) an investigation completed in 1983 by Collomoduul, an inter-industry foundation promoting standardization in the Netherlands.

A. A.T. Kearney Study of Improvements in Shipping Container Design

A.T. Kearney's investigation of shipping container design improvements began in March, 1984 and is expected to be completed by mid-1985. Developments leading up to the initiation of this joint industry project

and the extent to which modularization would be studied were discussed in Section 4.3.3-A. This section reviews the findings of the first phase of their investigation relating to shipping container size standardization.

A. T. Kearney identified and estimated the magnitude of benefits of opportunities for improving shipping container design. Twenty-nine such improvements were identified through: 1) a mail survey in which 31 manufacturers and 55 distributors responded; and 2) personal interviews with nine distributors. The opportunities were classified into five categories: dimensions, strength, closures, markings and other.[3] Table 5.1 lists the specific shipping container improvements in each category.

The 29 shipping container improvements were evaluated for their effect upon labor productivity, space utilization and damage in distributor warehouse operations. A rough estimate of savings for each opportunity was arrived at by calculating the impact upon the largest and most obvious of the three areas cited above.[4] The container improvements which were quantified are ranked by their potential savings in Table 5.2. Reducing the number of sizes to form a standardized container system had the greatest savings potential of 116 million dollars annually. Improving bag strength was second in terms of savings and three other container size-standardization options were among the top five saving opportunities.

The actual calculations used to produce the estimates in Table 5.2 were not reported in the Kearney Phase I executive summary. Only a brief description of the approach used and basic data input for the warehouse labor productivity, space use and damage impacts were given. Thus, it is difficult to evaluate the estimates. However, several general

Table 5.1 Five Categories of Shipping Container Design Improvements

A. Dimensions

- Standardization
- Chimney Stacking
- Standard Case for Like Retail Pack
- Standardization Carton Height
- Overhang/Underhang
- Reduced Pack Count on High Cube Items
- Reduced Case Weight
- Standard Pallet Height
- Height Greater than Length or Width

B. Strength

- Perforated Display Case
- Eliminate Gap Flaps
- Tray Pack Case Integrity
- Eliminate Kraft Wrap
- Interior Case Dividers
- Bags

C. Closures

- Gluing
- Cutter Damage
- End-Opening Cases

D. Markings

- Visibility of Marking on Tray Pack
- Improve Legibility of Markings
- Use of Nonglare Stretch Wrap
- Standardized Code Dating
- UPC Bar Coding Application

E. Other

- Slip Sheet Crimping
- Pallet Integrity for Small Light Cases
- Improve Brick-Pack Containers
- Minimize Between-Tier Glue
- Tray Pack Packing
- Minimize Strecth Wrap

Source: A.T. Kearney, "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at National-American Wholesale Grocers' Association Warehouse Operations Seminar, Dallas, TX, December 4, 1984, p. IV.8.

Table 5.2 Ranking of Shipping Container Improvements by Savings Potential

Rank	Opportunity	Cases Affected (Millions Per Year)	Savings to Distributors (Million Dollars Per Year)*
1	Standardization	11,400	116.0
2	Bag Strength	233	64.4
3	Standard Pallet Height	12,900	23.6
4	Standardized Carton Height	11,400	23.2
5	Standard Case for Similar Retail Package	1,400	14.2
6	Interior Case Dividers	5,400	8.7
7	Minimize Stretch Wrap	2,100	8.7
8	Standardize Code Dating	839	7.2
9	Height Greater than Length or Width	4,800	5.5
10	Minimize Between Tier Glue	1,000-2,000	3.5
11	Overhang/Underhang	4,800	2.8
12	Chimney Stacking	100	2.6
13	Gluing of Closures	114	2.3
14	Tray Pack Picking	300	1.9
15	Improve Legibility of Markings	12,900	1.6
16	Tray Pack Case Integrity	79	1.3
17	Perforated Display Case	315	1.0
18	Eliminate Kraft Wrap	300	0.5
19	Pallet Integrity for Small Light Cases	3,300	.3
20	Visibility of Marking on Tray Pack	791	.1
21	Improve Brik-Pak Containers	36	.1

*Savings for one area (the largest and most obvious) of distributor warehouse impacts (e.g., labor productivity, space use, or damage). Also savings for each improvement are not additive.

Source: A.T. Kearney, "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at National-American Wholesale Grocers Association Warehouse Operations Seminar, Dallas, TX, December 4, 1984, p. IV.8.

observations can be made. First, the approach used to estimate savings is narrow in two respects. It focuses on warehousing benefits only. Benefits in transportation to the retail store (which are shown to be considerable in the next section) and retail store level are excluded. Within the category of warehouse impacts, emphasis appears to be placed upon current operations (e.g. labor productivity) rather than longer term potential savings (e.g. warehouse automation or robotics) which might be realized if the shipping container design changes were implemented. Since the benefit estimation methods were not presented in the report it is not possible to determine the extent to which longer term considerations were included in the analysis. A second observation is that the potential savings for each shipping container design improvement are conservative estimates of distributor warehouse benefits. Only the largest and most obvious of labor productivity, space use and damage impacts was quantified to arrive at a "rough order of magnitude" savings figure for each improvement.[5] The two excluded impact areas need to be incorporated to arrive at a more accurate estimate of warehouse savings. To the extent that a shipping container improvement has significant benefits in excluded impact areas, Kearney's method understates its potential savings.

Kearney researchers, while acknowledging the rough nature of their estimates, used them to classify opportunities and select particular ones for analysis in the second phase of the study. Two important criteria were the magnitude of savings and number of cases affected. Opportunities which provided more than $10 million in savings and impacted greater than 6,500 billion cases per year were classified as having the "best long term potential." The only improvements in this category were container

standardization, standard pallet (unit load) height, and standardized carton height. None of these were chosen for further study. A second category, improvements which offered greater than $10 million in savings yet impacted less than 6,500 cases per year was determined to be a "good place to start" industry efforts to improve shipping containers. Thus, two opportunities which fell into this category, improving strength of bags and standardization of cases with similar retail packages, were selected for further analysis in the second study phase.[6]

B. A.D. Little Modularization Study

The A.D. Little investigation of modular packaging was confined to the dry grocery products flowing through the retail supermarket distribution channel. The study focused on evaluating impacts upon the wholesaler/retail chain distribution center and inbound and outbound transportation. Effects which were quantified included warehouse and transport space use, labor and equipment productivity, automation potential and damage reduction. The effect of modularization on container manufacturing costs, retail level productivity and training time of warehouse workers were qualitatively assessed.[7]

The basic approach A.D. Little utilized was to model the operations of four distinct "notional" warehouse types. The impact of modularization on warehousing variables was predicted through inferring from a variety of existing operational data and surveys. The range of potential improvements in each of the benefit categories is presented in Table 5.3. In Table 5.4 potential savings (updated to 1983 values) estimated for each warehouse type are illustrated. The magnitude of the savings is positively related to the use of pallets for retail store delivery. Note that the greatest saving potential exists for mechanized systems

Table 5.3 Areas of Savings from Modularization in Distributor Firms

	Estimated Savings	
	Mean	Range
Areas Quantified		
Warehouse Labor		
- Order selection	8.0%	3 - 13%
- Load assembly	32.5%	15 - 50%
- Truck loading	22.5%	20 - 25%
Damage Reduction		
- Warehouse	25.0%	21 - 29%
- Store delivery	37.5%	25 - 50%
Transportation		
- Space utilization	11.5%	3 - 20%
Areas Identified, but not Quantified		
Warehouse		
- Faster training of workers		
- Improved space utilization		
Retail		
- Direct warehouse to store shelf stocking and display on unit loads		

Source: A.D. Little, An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution, Report to the National Association of Food Chains (August, 1974).

followed closely by conventional warehouses using pallets. Automated and towline systems which do not ship on pallets showed significantly less savings potential. A.D. Little found that other opportunities which they were unable to quantify including faster training of warehouse workers, increased flexibility of storage space and automated systems, and direct warehouse to store shelf-stocking and display on pallets. Savings in container manufacturing costs were estimated to be insignificant.

A.D. Little researchers were hesitant to calculate an industry-wide estimate of the total savings potential of modularization. Several difficulties in making such a calculation were offered. First, the total savings figure would have to be based on a weighted average of the different warehouse types. Determining the appropriate weights, the study notes, is a difficult task especially for future periods. Second, the authors' cautioned that their calculations were for typical firms but were not necessarily industry averages. Third, they were also concerned about impacts on small but significant industry segments which had not been examined in their study and were thus not included in their estimates.[8]

The A.D. Little savings figures have been utilized in two instances to estimate industry-wide savings. Haberman, of the NAFC Productivity Council overseeing UPC and modular packaging studies, calculated a potential annual savings of 75 million dollars.[9] This figure was arrived at by assuming that an estimated 4.5 billion dry grocery cases sold per year were handled by conventional warehouses with modularization savings of $1.73 per 100 cases.

The General Accounting Office (GAO), in an investigation of opportunities to reduce food costs, estimated the potential savings attributable to modularization to be 178 million dollars annually.[10] This number was computed by using an estimate of 15 billion cases handled by warehouses annually and assuming that these cases were equally distributed among the four warehouse types of the A.D. Little study. It was not specified whether the 15 billion case figure, a 1972 estimate of the National Commission on Productivity (NCOP), included all products or solely dry groceries. A NCOP report on the food industry indicates that the figure represents the number of cases handled in the industry as a whole.[11] Thus, the GAO total savings estimate represents appregate benefits for all products which are warehoused. Extrapolating A.D. Little savings estimates, which were based on dry grocery warehouse operations, in this manner is probably inappropriate.

Both industry-wide savings estimates utilized the original 1974 A.D. Little figures and therefore did not account for inflation. Using the updated values in Table 5.2, Haberman's estimate in 1983 dollars is $174 million and the GAO's estimate is $400 million (range between $234 and $563 million dollars).

An improved calculation of modularization benefits can be made with the 1983 savings figures in Table 5.4 given a more precise estimate of cases handled and the mix of warehouse types. Table 5.5 illustrates the potential savings ranges for the three primary warehouse types and gives an industry-wide total benefit ranging from 106 to 248 million dollars per year. Modularization should also provide automatic palletization of cases coming off of existing automated and mechanized warehouses thereby producing additional gross[12] savings between 7.8 and 23.5 million dollars

Table 5.4 Summary of Potential Modularization Savings By Warehouse Type

	($ per 100 Cases Shipped)			
	Manual (Pallets)	Manual (Tow Trucks)	Mechanized (Pallets)	Automated (Carts)
1. Warehouse Labor*	1.99 ± .82	.44 ± .20	2.98 ± 1.35	.08 ± .08
2. Warehouse Damage*	.26 ± .04	.26 ± .04	.26 ± .04	.26 ± .04
3. Transport to Store**	1.11 ± .49	0	1.11 ± .49	.86 ± .37
4. Store Delivery Damage*	.50 ± .18	0	.50 ± .18	.06 ± .06
TOTAL	3.86 ± 1.54	.70 ± .24	4.85 ± 2.06	1.26 ± .55

*Figures converted to 1983 dollar values using an index calculated from wages for workers in the wholesale grocery trade in Employment and Earnings, published by the U.S. Department of Labor-Bureau of Labor Statistics.

**Figures converted to 1983 dollar values using the Procedures Price Index for refined petroleum products in Producer Prices and Price Indexes, published by the U.S. Department of Labor-Bureau of Labor Statistics.

Source: A.D. Little, "An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution," Report to the National Association of Food Chains, (August 1974), p. 2.

Table 5.5 Estimated Total Savings Potential of Modularization Per Year With Existing Warehouse Types and Technology

	Warehouse Types			
	Manual	Mechanized	Automated	Total
Estimated Annual Case Flow (Millions)	4,033.564	410.800**	75.636**	4,520.000*
Percent	89.24%	9.09%	1.67%	100%
Savings Per Year (Millions)				
Lower Bound	93.6	11.5	.5	105.6
Mean	155.7	19.9	1.0	176.6
Upper Bound	217.8	28.4	1.4	247.9

*Calculated by dividing 68,804.3 million dollars in wholesale dry grocery sales in 1984 by an average wholesale case value of 15 dollars. The wholesale sales figure was estimated by accounting for 21.9 percent and 19.4 markup on total retail sales of 60,901.5 and 25,103.8 million dollars for food and nonfood grocery sales, respectively (Progressive Grocer, p. 42, July 1984).

**Estimates calculated from data obtained through personal communication with several major materials handling equipment suppliers to the food industry.

Table 5.6 Present Discounted Value of Modularization Benefits

	Present Value of Savings (Millions)		
Time Horizon	Lower Bound	Mean	Upper Bound
10 years	756.15	1,263.50	1,770.85
20 years	1,006.87	1,682.56	2,358.02

per year. These estimates need to be qualified in several ways. First, the case flow[13] and warehouse mix are rough estimates made after consultation with experts on the wholesale food industry. Second, the A.D. Little study's limitations should be kept in mind.

The savings in Table 5.5 represent one period of the stream of benefits occurring through time. For modularization benefits to be weighed against conversion costs, the benefit flow needs to be translated into a comparable figure.[14] Discounting these future value of benefits or costs into a present value figure is the common procedure. A problem that arises is that the savings in Table 5.5 are based on current case flows and warehouse type distribution. It is very likely that these figures will change. In particular, one would expect that modularization would lead to more automated and mechanized warehouses and possibly new warehouse and distribution techniques, not yet conceived. Given this uncertainty, two assumptions will be made to permit calculation of the present value of the savings: 1) the number of cases handled will remain at 4.52 billion; and 2) the present warehouse mix will exist in the future. These are clearly conservative assumptions. Table 5.6 shows the present value of savings when discounted at 10 percent over a 10 year and 20 year time horizon.

C. Collomoduul Study

The Foundation for the Realization of Standardization of Distribution Packaging (Collomoduul) in the Netherlands conducted an investigation of modular packaging in 1983. Collomoduul had an independent organization survey to test warehouses using 40 different modular sized containers and compared them to a "control" warehouse with numerous sizes.

Productivity in order selection and loading potential were the focus of the study. For the warehouse using pallets, modular packaging produced a net improvement in productivity of up to 25 percent and an expansion of loading potential of up to 5 percent. Net productivity improvement for modular containers selected onto roll containers expanded up to 11 percent and loading potential increased a maximum of 10 percent.[15] Unfortunately, the lower bounds and mean values of modularization productivity benefits were not reported. When considering these estimates, one should keep in mind that the proliferation of items and sizes is less in the Netherlands. For example, 800 different container types have been found in a distribution center stocking 3,000 grocery items.[16] U.S. distribution centers carry from 5,000 to 8,000 items and over 2,500 different container sizes have been found.

The Collomoduul Study identified two additional areas which they did not quantify. First modular packaging can reduce the risk of damage. Second, modularization could provide future savings potential by lowering the potential for mechanization and perhaps robotics.[17]

5.2.2 Surveys

Four surveys of food system participants' attitudes relating to the effects of secondary package standardization have been conducted. Their results are summarized below.

A. A.T. Kearney Study of Improvements in Shipping Container Design

The joint industry study being conducted by A.T. Kearney was discussed earlier in Sections 4.3.3-B and 5.2.1-A. A fundamental objective of this study is to identify opportunities to improve productivity through improved shipping container designs. To fulfill this objective, Kearney

surveyed the perceptions of major food industry participants in the first phase of their study. A mail survey and personal interviews were utilized. The results of the mail survey were presented at a trade association meeting in December 1984[18] and are described below.

A questionnaire was mailed to all members of trade associations which were participating in the study (GMA, FMI, NGA and NAWGA). Questionnaires were returned by only 86 participants including 31 manufacturers and 55 distributors. The results are presented in Tables 5.7 and 5.8. As can be seen in Table 5.7, no manufacturer indicated that it received complaints regarding shipping container size proliferation from distributors. Pallet overhang, second only to the general problem of damage, was cited by 35 percent of manufacturers. Distributor respondents most frequently cited problems resulting from low strength cases and bags. As noted in Table 5.8, pallet overhang and proliferation of sizes were cited as troublesome areas by 31 and 24 percent of respondents, respectively. In their executive summary, A.T. Kearney made the following comments about the results:

> No single problem/issue was identified by more than 50% of the respondents. A review of the manufacturers and distributor's perception range from "no problems," to serious problems in damage, overhang, low strength cases and bags, resulting in an industry perception that there are no universal problems and therefore, no universal solutions.

The survey results and interview findings, which were not reported, were used to develop 29 specific shipping container improvements. The results of quantitative evaluation of these improvements were discussed in Section 5.2.1-A.

Table 5.7 Manufacturer Perceptions of Areas of Shipping Container Complaints from Dry Grocery Customers

	Number of Respondents	Percent
Damage	13	42
Overhang	11	34
Markings	7	23
Stackability	6	19
Poor closures	5	16
Shrink wrap	4	13
Glue between layers	1	3
Low density	1	3
Kraft overwrap	1	3
Bails	1	3
Hard to open cases	1	3
Razor damage	1	
"No problems"	2	6
"No data"	2	6
"Non-dry grocery"	2	6
Total Manufacturers	31	

Source: A.T. Kearney, "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at National-American Wholesale Grocers Association Warehouse Operations Seminar, Dallas, TX, December 4, 1984, p. IV-3.

Table 5.8 Distributor Perceptions of Shipping Container Problems/ Issues Affecting Productivity in the Dry Grocery Industry

	Number of Respondents	Percent
Low-strength cases	26	47
Bags	19	35
Overhang	17	31
Too many sizes	13	24
Tray packs	12	22
Plastic containers	11	20
Shrink wrap	10	18
Markings	7	13
Poor closures	5	9
Square cases	4	7
Low-strength inserts	4	7
Hidden damage	3	5
Glue between layers	2	4
High-cube items	2	4
Bailed bags in plastic	2	4
Hard to open cases	2	4
Kraft overwrap	2	4
Bags bailed in paper	2	4
Pallet interlock	1	2
Nonconveyorable items	1	2
Total Distributor Respondents	55	

Source: A.T. Kearney, "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at National-American Wholesale Grocers Association Warehouse Operations Seminar, Dallas, TX, December 4, 1984, p. 4.

B. National Center for Productivity and Quality of Working Life Report

Bowersox and Monczka conducted a study in 1978 to determine if any productivity innovations in the food industry had been impeded by corporate concerns about federal rules prohibiting anticompetitive collusion.[19] A literature review and 15 interviews were utilized to construct an inquiry document which was then used in surveying food industry managers' perceptions. The survey was conducted in two parts. Ninety-one top level distribution executives completed the questionnaire at the 1978 GMA Distribution Council meeting. The survey instrument was also mailed to top level managers to gain their perspective and 53 executives responded. A total of 144 individuals completed the questionnaire and a breakdown by organizational type is presented in Table 5.9.

Two categories of results reported from the study are particularly relevant here. They are: 1) awareness of cooperative behaviors; and 2) likelihood of productivity improvements resulting from cooperative behaviors. Of ten possible cooperative behaviors, respondents were most familiar with cooperation among competitors to standardize package sizes to improve handling productivity. Attitudes about the productivity impact of each cooperative innovation were ascertained by having respondents indicate each innovation's impact on a five point scale (with five representing the greatest productivity impact) and rank the relative innovations. Cooperative action to standardize package sizes was given by far the highest scale rating and was ranked first among all innovations by all organizational types in the sample. The scale ranking of results is shown in Table 5.10. Further analysis of the results showed that 75.1 percent of individuals responding perceived package standardization to have a 4 or 5 rating or a significant or very significant potential for

Table 5.9 Respondent Profile of NCPQWL Study

Organizational Type	GMA Distribution Council	Mail Survey	Total
Retailer	10	23	33
Wholesaler	11	9	20
Manufacturer/Processor	65	19	84
Other	5	2	7
Total	91	53	144

Source: Donald J. Bowersox and Robert J. Monczka, "Perceived Impact of Federal Laws and/or Regulations on Productivity Innovation in the Food Industry: A Fact Finding Study," Report to the National Center for Productivity and the Quality of Working Life, (June 1978), p. 21.

Table 5.10 Food Industry Participants' Rating of the Productivity Impact of Cooperative Behaviors

Cooperative Behavior	Average Productivity Impact Score*				
	Overall	Retail	Wholesale	Processor	Other
A. Cooperation among competitors to standardize package sizes to improve handling productivity.	4.064	4.523	4.350	3.805	3.571
B. Joint ownership of transportation equipment.	3.127	3.400	2.772	3.138	3.000
C. Combined ownership or shared leasing of warehouse facilities.	3.299	3.256	2.500	3.266	4.143
D. Pooled inventories for joint use in the distribution channel.	3.134	3.026	3.167	3.134	3.214
E. Information exchange via encoding symbols (or other technology).	3.126	3.060	2.860	3.166	3.285
F. Jointly owned pallet pools.	2.789	3.015	2.660	2.707	3.143
G. Arrangements to perform packaging and labeling of products.	2.942	3.094	2.883	2.888	2.928
H. Centralized price marking or stock identification of product for retailers by manufacturers.	3.169	3.255	3.281	3.057	3.000
I. Future contracting of product purchases.	2.740	2.553	2.639	2.838	2.214
J. Existing organizations performing warehousing and/or transportation services for competitors.	3.308	3.276	3.450	3.265	3.572
Number of responses	N=144	N=33	N=20	N=84	N=7

*Explanation of rating: 1) no productivity improvement; 2) sight productivity improvement; 3) moderate productivity improvement; 4) significant productivity improvement; 5) very significant productivity improvement.

Source: Donald J. Bowersox and Robert J. Monczka, "Perceived Impact of Federal Laws and/or Regulations on Productivity Innovation in the Food Industry: A Fact Finding Study," Report to the National Center for Productivity and the Quality of Working Life, (June 1978), p. 25.

improving productivity. Individuals in the manufacturer-processor category gave the package standardization the highest scale rating and ranked it first among all productivity innovations. This is interesting in light of the fact that the distributor side of the business has been generally thought to be the primary beneficiary of handling productivity from package standardization.

C. Government Accounting Office Study

In 1978 the GAO studied modularization of containers as a means of reducing food costs.[20] The research included personal interviews with 20 distributors, 20 manufacturers and four container manufacturers.

The interview results indicated that distributors expected to receive considerable cost savings while food manufacturers felt they would bear the cost of modularization while receiving few, if any, benefits. Distributors indicated that modular containers would produce productivity gains, promote automation, reduce damage and improve space use. Opinions regarding the greatest area of savings differed. Firms were almost unanimous (19 or 20) that modularization would improve productivity and reduce damage. Twelve firms identified greater automation including automatic palletizing and better space use as potential benefits. Order selection productivity, damage reduction, and warehouse space savings were each ranked as the greatest benefit by at least one distributor in the sample. Additional comments suggested improved inventory control and retail shelf space use, and potential savings through prepriced display modules which could conceivably eliminate the need for a shipping carton.

Manufacturers held quite different views regarding the effects of modularization. Eleven of the nineteen firms responding saw none or

insignificant benefits from modularization. Eight manufacturers stated that their firm would receive some benefits but that the bulk of the savings would accrue to distributors while they would bear the conversion costs. The major benefit area, which was identified by 10 firms, was that of better warehouse space utilization. Reduced loading time in shipping and receiving operations and reduced product and packaging inventories were mentioned by nine firms. Five manufacturers believed they could benefit through improved space use in their plants while three firms believed investment in packaging machinery investment could be reduced. Two manufacturers stated that they would benefit from longer production runs if the number of retail sizes diminish. One firm pointed to savings from less frequent size changes while the other mentioned shipping container costs.

Four package material manufacturers were interviewed in the GAO investigation. Three of these firms saw few modularization savings, while one indicated a possible reduction in damage claims for defective containers. Three of these firms indicated that modularization would involve few costs to them since their equipment is very versatile.

D. Progressive Grocer Survey

A 1982 survey by this trade magazine attempted to identify attitudes of and specific points of contention between manufacturers and distributors. Specifically, the survey asked both parties to: 1) rank 26 different opportunities to improve overall performance; 2) indicate whether improvement had occurred in the past year for each opportunity; and 3) assess the share of the blame for lack of improvement.

The ranking of opportunities to improve system-wide performance is presented in Table 5.11. Distributors ranked shipping-case

5.11 Ranking of Opportunities to Improve Overall Industry Performance

Area	Ranked by Distributors	Manufacturers
Cash discount period	1	20-23
Backhaul arrangements	2	15/16
Incomplete shipments	3/4	17-19
Clear understanding of each other's business	3/4	1
Timely notification on deals	5/6	20-23
Extended terms for slow movers	5/6	24/25
Delayed shipments	7	17-19
Shipping-case standardization	8	13/14
Proliferation of item sizes, varieties, etc.	9	13/14
Competence of salesmen	10	6
Cooperation on mutual long term goals	11	2/3
Performance required on deals	12	12
Cooperation on mutual short term goals	13	8/9
Direct (backdoor) selling to stores	14	20-23
Cooperative use of scanning data	15-19	4
Contract language on deals	15-19	20-23
Shipping procedures to facilitate unloading	15-19	15/16
Procedure on discounting items	15-19	17-19
Quality of merchandising suggestions by suppliers	15-19	10/11
Total number of deals	20/21	10/11
Pressure tactics by manufacturers	20/21	26
Competence of buyers	22	5
Performance rendered on deals	23	2/3
Special needs of mechanized warehouses	24	24/25
Quality of merchandising activities by distributors	25	7
Pressure tactics by distributors	26	8/9

Source: Progressive Grocer, "Where Does Industry Lock Horns," (January 1982), p. 34.

standardization eighth while suppliers placed it approximately halfway (13/14) among the 26 opportunities.

Two other aspects of the survey results are noteworthy. First, both parties felt that very little improvement in the shipping case standardization opportunity had occurred between 1981 and 1982. Improvement regarding standardization was ranked 25th out of the 26 opportunities.

A second interesting result was who the parties blamed for lagging system productivity growth and product damage in the food distribution channel. Distributors placed 55 percent of the burden for lagging productivity growth on their counterparts. Manufacturers put 53 percent of the blame on distributors. Regarding product damage, manufacturers attributed 64 percent of the blame on distributors. Distributors, however, attributed 55 percent of the blame for damage to manufacturers.[21] Unfortunately, details were not given on the number and type of individuals surveyed in this article.

6.2.3 Qualitative Assessments of Impacts

The literature search found numerous statements about the potential effects of standardization and modularization of shipping containers. The majority of these qualitative assessments pointed to considerable savings at many stages in the food distribution chain. Table 5.12 gives some representative quotes. Several comments indicating less favorable modularization impacts are presented in Table 5.13.

The quotes indicating potential savings come from a broad spectrum of food industry participants including academic and government researchers, government commissions, a package and materials handling equipment vendors, distributors and a food trade association. Notably absent are

Table 5.12 Qualitative Positive Assessments of Modularization Impacts

Academic Researchers

"Some degree of standardization in shipping cartons would improve productivity along the line in physical distribution...in the case of dry groceries, the lack of standardization in carton sizes wastes space, causes product damage, and perhaps most important of all acts as a barrier to truly automated warehousing." (G.F. Bloom, Massachusetts Institute of Technology, Journal of Food Distribution Research, p. 14, July 1972.)

"...Although a complex and ambitious task, modularization of secondary shipping containers would facilitate stable mixed product stacking, a giant step toward the reduction of losses and overall efficiency improvement... Modularization would also facilitate the use of more standard mixed product pallet loads for store delivery. Such shipments would reduce handling costs and losses. Also, in the long run it seems clear that mechanized materials handling equipment cannot achieve its full potential without modularization of secondary cartons." (T.R. Pierson, J.W. Allen and E.W. McLaughlin, Michigan State University, Dry Grocery Losses, p. 28, 1982.)

Government Researchers

"Reduction in marketing costs can be achieved through the use of standardized package sizes. In addition to lower inventory investment in packaging materials, mass production of the fewer types of consumer packages and shipping boxes is facilitated. Size standardization can help make more efficient use of storage space at all levels of distribution and simplify, expedite and cut the costs of handling and shipping." (D.R. Stokes, USDA-Agricultural Research Service, Journal of Food Distribution Research, p. 91, October 1970.)

Government Commissions

"The center found that the use of modular shipping containers could reduce waste, make better use of truck capacity, and facilitate warehousing." (National Center for Productivity and Quality of Working Life, p. 32, 1978.)

"...A modular system using standard containers and pallets can improve productivity in three ways: 1) less wasted space in trucks, trains, warehouses, and stores; 2) less damage to food products in shipment; 3) less wasted labor at all points." (National Commission on Productivity, p. 27, 1975.)

"...The lack of standardization in packaging is a serious obstacle to improved materials handling in retail stores and in warehouses....The reason standardization of shipping containers is important is that with only a few carton sizes, fully automatic warehouses would be feasible. Such facilities, according to one estimate, could result in savings of as much as 2.5 cents per case handled." (National Commission on Productivity, p. 17, 1973.)

Package Suppliers

"Corrugated cases will trend away from merely fitting the cubic volume of their contents and into modules with external dimensions to permit ease of palletizing and load building in loads with identical or mixed cases. By sizing cases in this manner, the problem and damage resulting from break-up in distribution centers will be markedly reduced." (A. Brody, Mead Packaging, in Presentation to Food Processors Institute, pp. 7-8, February 1980.)

Materials Handling Equipment Suppliers

"The savings to your industry through improved packaging, in terms of size, quality and standard coding, would be immense. Packaging changes will significantly reduce costs in a convention manual warehouse, as well as one that is automated and, would substantially reduce the complexity of robotized handling..." (J. Bradt, SI Handling Systems in Grocery Distribution, p. 16, Jan./Feb. 1981.)

"Until packaging standards are developed on an industry-wide basis, automation of warehouse operations will be limited." (J. Bonthious, Distribution Planning, Inc. in Grocery Distribution, p. 10, Jan./Feb. 1983.)

"...in a number of facilities, highly mechanized conveyor systems work along with floor to ceiling storage/ retreival installations, automated floor vehicles, etc. It is certain that the advent of modularization would greatly enhance productivity in all these operations." (H. Fernstrom, Barrett Electronics, in Grocery Distribution, p. 27, March/April 1980.)

"Speaking with specific regard to the conveyor system, we often have to overdesign, so to speak, to accomodate not for what is processed now, but for what might be (processed) in terms of package sizes. And when you consider the two to four year lead time involved in system design, the advantage of a standard secondary packaging practice is obvious." (Robert V. Riddle, Systems Development Warehouse Systems, in Supermarket News, p. 43, April 11, 1977.)

Distributor Firms

"Automation is needed for future advances in productivity. Now is the time to consider an industry-wide effort to standardize packaging in terms of size, quality, and coding. The economic savings will be substantial in the distribution system." (P. Canavan, Stop and Shop, Inc. in Journal of Food Distribution Research, p. 51, 1981.)

Table 5.12 (Continued)

"We don't have the range of sizes, shapes and weights that robots can handle...we have got to get together and get the sizes and shapes down to a number that can be handled - perhaps 200 or 300. Savings in this total area are staggering for everyone." (J. Leavitt, Springfield Sugar, in Supermarket News, p. 2, May 16, 1983.)

"...standardization of case sizes is the greatest single thing manufacturers can do for us...But that is the most important thing they can do for people at the distribution end to produce more efficiency, mechanization and automation." (J. Alexander, Certified Grocers of California, in Grocery Distribution, p. 2, March/April 1978.)

"If the industry can determine a limited range of modular sizes for the wholesale package, it is completely possible that, since the product need not be price marked at the store, we will be able to carry the modular secondary package directly to the shelf and load it like a cassette cartridge....No longer need our clerks handle the individual can in the pack out process. Damage and labor cost would be reduced to the absolute minimum." (A. Haberman, First National Stores, in Journal of Food Distribution Research, p. 51, February 1975.)

"We also intend to receive the ecological benefits that can flow from a system of modularized pcakging. Greater cube usage affords us the opportunity to lower our gasoline consumption -- to require fewer trucks with less steel, aluminum and plastics that must go into those trucks -- and the ultima-e result will be that fewer highways will have to be built. Our natural resources are precious and modularized packaging will help to preserve them." (G. Gentry, Jewel Co., Presentation to the NAFC Annual Meeting, October 1973.)

Food Trade Associations

"Another innovation with tremendous potential for productivity improvement is modularization of secondary packages (shipping containers). Automated or mechanized warehouses cannot reach their full potential unless a modular system is developed....The problem currently limiting the application of this technology is the difficulty of stacking cases from different manufacturers onto pallets for shipment to individual stores. Since these cases are not size-related by standard multiples (modular), load stability is a major problem." (T. Hammonds, Food Marketing Institute, in Journal of Food Distribution Research, p. 12, February 1977.)

Miscellaneous

"The development of standards for modular containers and rapid adoption by industry could aid in making materials handling equipment more productive. Equipment could be designed and built to closer specifications and operating requirements, allowing more accurate and timely product handling. Automatic storage and retreival systems could operate with fewer adjustments and reduced down time. Primitive and relatively inexpensive robots could be used for many food handling tasks if standardized containers, modules, and pallets are used and the robots programmed to recognize them and work within standardized parameters. (W. Gordon, Battelle Institute, Journal of Food Distribution Research, p. 93, February 1984.)

"The standardization of the secondary shipping case is the key ingredient for the future success and development of the automated warehouse (R. Kochersperger, author of Food Warehousing and Transportation, p. 497, 1978.)

"Food distributors and the equipment manufacturers and consultants augmenting their operations are unanimous in projecting package modularization as the golden opportunity for the future, but they wonder about the feasibility of food manufacturer cooperation." (Richard DeSanta, commenting on discussions at the Conference on Computer Based Technology in Food Distribution, April 1977 in Supermarket News, p. 43, April 11, 1977.)

Table 5.13 Qualitative Negative Assessments of Modularization Impacts

"The push toward automation is not much stronger for the wholesaler or retailer whose materials handling operation is so labor intensive. Package standardization would be a little help here--but only a little. For the quantities per order are so small and the number of items so large that we would need a system totaling thousands of different operating elements--even if every package were the same size." (W. Friedman, Friedman and Co., in Journal of Food Distribution Research, p. 20, September 1973.)

"We urge that any standards which are adopted for cases and their primary containers take into account automation performance characteristics that may be influenced by final choices of standards. Before standards are frozen, automation-equipment manufacturers should be urged to provide substantive information on factors which will influence the design and operation of their equipment. Since bold new approaches to warehouse automation are not yet underway, one might argue it is not the time to initiate an intensive effort on case standardization." (J. Reintjes, Massachusetts Institute of Technology, p. 28, An Exploratory Study of Possible Applications for Modern Technology in the Retail Food Industry, 1974.)

manufacturers. While the entire gamut of potential benefits from package inventory savings to retail shelf space use are commented upon modularization benefits have been mentioned most frequently in connection with productivity advances in mechanized and automated materials handling of distributors. This could be due to the fact that the greatest potential benefits lie in this area or because certain parties which would receive more concentrated benefits from standardization (e.g. materials equipment vendors or mechanized/automated distributors) have been more vocal since they have a greater stake in this issue.

The negative assessments in Table 5.13 deserve some discussion. Friedman's comment in 1973 suggests that even with one uniform case size, the complex nature of wholesale warehouses will make automation difficult. Reintjes comment is of an entirely different sort. The question he raises, that innovation materials handling equipment must be developed before standard case sizes, appears to be one of whether the chicken or egg comes first. One could postulate that the reason that "bold new approaches to warehouse automation are not yet underway" is due to the existing proliferation of sizes. Some evidence to support this are the appeals by equipment vendors to the food industry to standardize case sizes in Table 5.12. One vendor stated that in developing warehouse systems, they are dealing with "packaging as it is."[22] However, Reintjes points out about the need for input from equipment vendors in devising standards and the potential dangers of freezing innovation are well taken.

5.2.4 Quantitative Assessments of Modularization Impacts

Several quantitative assessments of modularization savings by individuals familiar with various operations of the food industry have been attempted. Bloom states:

> One of the most knowledgeable men in the food industry on the subject of warehousing, in a conversation with the writer, that standardization of shipping cartons could save a cent a case in handling by making possible mechanical unloading of pallets with a palletizing machine, and perhaps another half a cent a case through more efficient general warehouse handling.[23]

At least one quantitative assessment of potential savings of modularization at the manufacturing level has been made. In 1974, a large U.S. food manufacturer estimated that modular containers could save this firm 1.5 cents per case of product.[24]

5.3 Evidence of Net Benefits: Rationale for the Analysis of Institutional Barriers

Information is needed on modularization benefits and costs in order to determine if modularization passes the benefit-cost test and would thus produce net benefits or system savings. As noted, there are several difficulties in obtaining accurate predictions of modularization impacts. Foremost is the fact that modular concept has not been operationally specified into the number of and specific sizes. The lack of knowledge of specific modular sizes makes it especially difficult to assess the costs to manufacturers, including possible impacts for retail packaging. However, the general direction of benefits for manufacturers have been identified and have been, in a few cases, refined into estimates. These were reviewed in the last section.

The physical costs of modularization appear to be directly related to: 1) the degree to which retail packaging is affected; and 2) the time

period allowed for implementation. Because retail packaging equipment is relatively less flexible than shipping container equipment, conversion costs depend primarily upon required changes in the retail package. The number of sizes in a modular system would determine the degree to which retail sizes would be affected. A system with a large number of sizes might only require minor changes in retail packaging and adjustments in case count involving few costs. Conversely, a modular system with very few sizes would entail much greater retail package change and costs. Since the number of modular sizes have not yet been specified, it is not possible to predict the degree of retail package change and associated conversion costs for manufacturers. Thus, one part of the information needed to make a net benefit comparison is not yet known.

The physical costs of conversion to modularization are a function of the implementation period. As the time allowed for modular sizes to be implemented is expanded, conversion costs should be reduced as modularization equipment changes are made in conjunction with other changes. For example, modular sizes could be adopted in the new product introduction process, with changes to metric sizes, or during the normal overhaul and replacement of existing equipment.

Information is needed on the benefits of modularization for a net benefit comparison. The evidence presented in this chapter indicated that there are definite savings of considerable magnitude at the distributor level and likely to be savings at the manufacturing level from modularization. Two studies have empirically documented substantial savings from modularization in distributor warehousing and transportation functions. Benefits at the retail level and in several other areas including potential warehouse automation benefits should be added

to these savings figures. The wide spectrum of views represented in the qualitative evidence suggested that in general modularization was a significant opportunity to improve physical distribution productivity and lower costs.

Evidence on potential savings from modularization came primarily from surveys, not empirical investigation of actual effects. As noted, the GAO study found only eight of nineteen manufacturers that believed modularization would produce significant benefits for their operations. However, manufacturers, as did distributors, ranked package standardization as having the greatest productivity impact of ten possible cooperative endeavors in the NCPQWL study. Based on this evidence, it appears at least some manufacturers would receive benefits from modularization and most believe it would have a positive impact on productivity in the industry as a whole.

After reviewing the evidence, the question of whether modularization would produce net benefits can now be addressed. This research concludes that one or possibly more modular packaging systems would produce net benefits and thereby lower total food distribution system. This conclusion is based on five points. First, a modular system would have reasonably low conversion costs if: 1) it had a sufficient number of sizes so as not to require substantial retail package change; and 2) a reasonable implementation period so that manufacturers operations would not be quickly disrupted and changes could coincide with the normal cycle of package change. Second, despite the fact that modularization has been a food industry issue for over 15 years, no quantitative evidence was uncovered in this research which demonstrated that conversion costs would be large. Third, conversion costs would for the most part be one

time costs while savings would be ongoing through time. Fourth, some manufacturers would receive benefits from modularization which would at least partially offset conversion costs. Finally, the quantitative estimates of distributor benefits appear to be conservative since benefits in retailing or from technologies stemming from modularization have not yet been estimated.

An obvious omission from the above discussion are potential marketing impacts. These were excluded on the basis of: 1) a lack of knowledge of the degree to which retail packages would be affected; and 2) uncertainty as to whether effects on individual firms' ability to differentiate and promote its product are relevant in a systems or broader welfare calculation. If modularization prevents manufacturers from providing products that consumers prefer, then this clearly would be a negative effect which should be included in the calculation. On the other hand, if greater similarity in retail packages allows consumers to compare products on more of a price basis and leads to greater price competition and lower prices, this could be considered as a positive modularization impact.

Given the conclusion that net benefits for some modular package system(s) exist, the following questions are raised: 1) What prevents the adoption of modular containers? 2) Why don't the beneficiaries of modularization (primarily distributors) make a bid to manufacturers to accomplish the change and reduce their costs? Two broad categories of variables are hypothesized to be necessary for such an exchange to take place: 1) information about the good being exchanged; and 2) an institutional mechanism for the transaction. The heart of this research, covered in Chapters 6, 7 and 8 of the thesis, will be to further identify

and analyze barriers to modular packaging adoption. Specifically, informational variables and institutional variables will be investigated in Chapters 6 and 7, respectively. Chapter 8 will attempt to integrate the analysis, identify important trends affecting adoption and suggest institutional innovations.

5.4 Chapter Summary

The effects of implementing modular packaging were conceptualized in the first section of the chapter. A model of the benefits and costs of modularization for manufacturers, distributors and consumers was developed. Possible impacts on marketing and first- and second-round physical impacts upon manufacturers and distributors were considered. Two general areas of impact of modularization upon consumers were discussed. First, if retail package sizes are limited, some consumers may be less satisfied with the attributes of the new products. Second, consumers will be affected by product prices. Consumers would benefit from modularization through lower prices if: 1) the modular system developed produced net system savings; and 2) competition at the distributor level was sufficient so that at least some of the net savings were passed to consumers. Since modular packaging has not yet been operationalized into specific sizes, the effects could only be outlined in a general, rather than specific, manner.

The available evidence on the effects of modularization was reviewed. Four categories of evidence exist. First, original empirical studies focusing upon distributor warehouse and transportation functions have documented substantial savings in labor cost, space use and product damage. Second, surveys of food industry participants indicated that

modularization is widely perceived to have significant potential for improving productivity and lower costs in food distribution. Most manufacturers believed modularization would improve productivity for the industry as a whole and some firms predicted savings in their own operations. Third, a review of qualitative assessments of modularization impacts by diverse food industry participants was presented. The majority of these assessments portrayed modularization as a substantial opportunity to increase productivity using present methods and as a necessary change for adoption of existing and future warehousing technologies. Finally, several quantitative estimates of modular packaging benefits by knowledgeable persons in the food industry were presented.

The final section of the chapter attempted to determine whether modularization would pass the benefit-cost test and provide benefits to the total food system. Only part of the information needed to make such a comparison is presently available. In particular, no empirical evidence has documented the costs and possible benefits for manufacturers. Manufacturers costs are likely to decline as the number of sizes in a modular system increase and the implementation period is extended. Also, distributor benefits have been documented to be significant. Thus, it was concluded that one or more possible modular systems exist which would yield substantial net system savings.

Given the above conclusion, a fundamental question is raised. "If benefits exceed costs, why isn't modular packaging adopted?" In other terms, why don't the beneficiaries of modularization compensate those who would incur costs so that modularization is adopted? A number of institutional factors affect whether such an exchange takes place. These institutional barriers are the focus of the remaining chapters.

CHAPTER 5

FOOTNOTES

[1]This problem arises for any innovation in its infancy. For example, the general benefits of implementing a Universal Product Code (UPC) symbol which would permit optical scanning of packages at supermarket checkout stands were studied by Ricker and Kruekenberg (1971) and McKinsey (1971) before a symbol was agreed upon in 1973. See Robin N. Shaw, Universal Product Code Scanning Systems: The Retail Experience, 1974-1976, Cornell University Agricultural Economics Staff Paper No. 77-32 (August 1977), pp. 22-24.

[2]Robin N. Shaw, Universal Product Code Scanning Systems: The Retail Experience, 1974-1976, Cornell University Agricultural Economics Staff Paper No. 77-32 (August 1977), pp. 18, 268.

[3]A.T. Kearney, "Executive Summary of Phase I Results of Joint Industry Study of Shipping Container Design," presented at the National American Wholesale Grocers Association Warehouse Operations Seminar, Dallas, TX (December 1984), pp. IV.1-IV.4.

[4]Ibid., p. III.4.

[5]Ibid.

[6]Ibid., pp. V.2, V.3.

[7]A.D. Little, Inc., An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution, Report to the National Association of Food Chains (August 1974).

[8]Ibid., p. 3.

[9]Alan L. Haberman, "Standardized Case From the Retailer's Viewpoint - Efficiency of Handling, Faster Storage, and Withdrawals, In-Store Merchandising Uses: Problems to Be Solved," paper presented at the 1975 National Packaging Week Assembly, New York (October 1975), p. 13.

[10]U.S. General Accounting Office, What Causes Food Prices to Rise? What Can Be Done About It? CED-78-170, Washington, D.C. (September 1978), p. 84.

[11]National Commission on Productivity, Productivity in the Food Industry: A Preliminary Study of Problems and Opportunities, Washington, D.C.: Government Printing Office (1973), p. 17.

[12]The cost of investment in palletizing equipment would need to be subtracted to yield a net benefit figure for distributors.

[13]The annual case flow figure of 4.52 billion may be quite conservative. A.T. Kearney estimated that 12.9 billion cases of dry grocery products are manufactured annually. Flow into the food service channel could account for some of the difference between these two figures.

[14]Studies of other industry-wide innovations (e.g., UPC and Uniform Communications Standard - UCS) have displayed their estimates in annual benefits per year. Perhaps this is in response to the industry's interest in improving short-run performance. It strikes this author that researchers could be more thorough in their treatment of effects in the future and, thus, add to the understanding of comparison of flows of benefits to one time conversion costs.

[15]Sybolt A. ten Have, The Advantages of Modular Distribution Packaging, Amstelveen, The Netherlands: Collomoduul (June 1983), p. 16.

[16]Ibid., p. 3.

[17]Ibid., p. 4.

[18]A.T. Kearney, "Executive Summary of...".

[19]Donald J. Bowersox and Robert J. Monczka, Perceived Impact of Federal Laws and/or Regulations on Productivity Innovation in the Food Industry: A Fact Finding Study, Report to the National Center for Productivity and the Quality of Working Life (June 1978), p. 25.

[20]U.S. General Accounting Office, Redesigning Shipping Containers to Reduce Food Costs, CED-78-81, Washington, D.C. (April 1978).

[21]"Where Does Industry Lock Horns?" Progressive Grocer (January 1982), pp. 34, 37.

[22]Jack Bradt, "Mechanization Automation--A Look at the Future," Grocery Distribution (January/February 1981), p. 161.

[23]Gordon F. Bloom, Productivity in the Food Industry: Problems and Potential, Cambridge: Massachusetts Institute of Technology Press (1972), p. 130.

[24]A.D. Little, Inc., "Sizing Things Up," The Bulletin, No. 509 (September/October 1974), pp. 2-3.

CHAPTER 6

INFORMATIONAL BARRIERS: PARTICIPANTS' KNOWLEDGE OF MODULARIZATION AND ITS EFFECTS

The adoption of an innovation depends upon the awareness and knowledge of the particular innovation and its likely effects. For a system-wide change, this knowledge is critical because understanding and agreement is necessary before coordinated efforts toward implementation can be made. In cases where the benefits and costs are unevenly distributed between industries, knowledge of the benefits and costs are prerequisite for either individual or collective discussions and bargaining necessary for trade-offs to be made between sectors. This chapter presents informational barriers to modular packaging found through a literature review and interviews with food industry participants.

6.1 Literature Review Findings

The literature search revealed barriers relating to: 1) the lack of awareness of modularization; 2) operationalization difficulties; and 3) lack of information on its effects.

6.1.1 Awareness of Modularization

The awareness and understanding of modular packaging and its potential cost savings was identified as a barrier by some food industry participants. In the GAO study, 25 percent of the distributors interviewed perceived the lack of communications about modular packaging as a major factor inhibiting adoption. One firm stated that the whole industry is

ignorant of the potential benefits. Another firm interviewed believed increased industry awareness of the concept was needed for any progress to be made.[1] A NCOP report supported this awareness problem stating "the food producers and retailers who can affect the increase of modularization have not yet realized its economic advantages."[2] This as well as other comments emphasized the need for greater study of potential savings and costs to increase awareness and thus spur progress. Section 6.1.3 elaborates on that aspect of information barriers.

Some other evidence suggests that participants' awareness has not been a major impediment. Whitehead, an A.D. Little researcher, states that "...for some time there has been a general awareness that modularization would be beneficial...."[3] Supporting evidence came from the NCPQWL survey of distribution and top level executives in the industry. The study found that such managers were the most familiar with standardizing package size of ten possible cooperative behaviors to improve productivity.[4]

6.1.2 Difficulties in Operationalizing the Modular Concept

A related but distinctly different type of informational obstacle involves operationalizing the modular concept. This has, in turn, contributed to a lack of understanding of the concept and uncertainty about the effects of modularization. For example, Bloom concluded:

> All members of the food industry seem to agree that modulation of carton sizes would be a good thing, but no one knows what the optimum module would be.[5]

Thus, while many food industry participants may be aware of the concept, they may not have an understanding, or may have very different understandings, of how it would be operationalized into a number of specific

sizes. In the literature, food industry participants have interpreted the number of container sizes in a modular system to be as low as 10 and as high as 300. The particular number of modular sizes certainly affects the kind and nature of impacts of modularization. Each participant's interpretation of how the concept will be operationalized affects how they view the benefits and costs and thus the economic viability of the concept. An example is that of marketing impacts. Many manufacturers have an interpretation of modular systems which would severely impact retail package design flexibility and thus view modularization as having very high costs for their side of the business. Distributors may have a different interpretation of how the concept would be operationalized and thus a markedly different perception of impacts. In short, the lack of refinement of the modular concept into specific sizes leaves room for selective interpretation of modularization which, in turn, impedes the necessary communication for implementation. This subject is pursued in greater detail in Chapter 8.

6.1.3 Information on Modularization Effects

The lack of information on benefits and costs of modular packaging has been identified as an impediment to implementation by numerous food industry observers and participants. Information on impacts was cited as a barrier for two reasons. First, the potential cost savings need to be demonstrated and quantified to increase awareness of and to provide impetus for change to modular packaging.[6,7] Secondly, information on net system benefits is necessary to determine if modularization could produce lower overall costs and thus lower food prices.[8,9,10]

While the A.D. Little study documented potential warehousing and transportation savings for supermarket distributors, the savings and

costs for other industry sectors were not studied. However, the authors do pose the net benefit question to the industry in their recommendations.

> Do the potential benefits justify the projected changeover in industry practices? Before deciding to implement a modularization program, detailed studies of the total effect of each specific proposal, including conversion costs are necessary. We need to determine the net benefit throughout the system including additional expenses and investment.[11]

Haberman, noting the partial approach of A.D. Little, suggested that the two major areas of cost disadvantages from modularization were: 1) possible restriction on freedom in the marketing area; and 2) conversion cost.[12] With regard to the former, Haberman admits he does not know how restrictive modularization would be, but suspects the sacrifices in this area might not be as large as one's first reaction might tell them. With regard to the latter, he argues that these costs must be minimized through modular conversion in the normal cycle of package equipment change in the industry. However, if these costs are too great, he believes modular packaging cannot be implemented. Haberman emphasized the point that no work had been undertaken on costs of modularization and much work needed to be done to move the modular idea forward.

As indicated above, many researchers and food industry managers believe that greater information on effects is needed before the economic viability of modularization can be judged and implementation can commence. Several exceptions to this view are worth noting. The GAO study concludes that the food system as a whole is likely to benefit from modularization even though some sectors (manufacturers) will incur greater costs. Also, U.S. Department of Agriculture researchers who have conducted studies in the area of package modularization have indicated that, in some cases, benefits would be great enough to justify adoption of container standardization and modularization.[13] Finally, a study of dry

grocery losses takes the view that the task of modularizing will be arduous, but that the results appear certain to be worth the effort. A modularization program was identified as a requisite action to reduce food losses and improve food distribution system effectiveness.[14]

6.2 Interview Results

Several information-related barriers to modularization were pursued in the early part of each interview. The following discussion reviews the interviewee responses according to the three areas of the interview guide: 1) awareness of the container size proliferation problem; 2) awareness and understanding of modular packaging; and 3) the probable effects of modularization.

6.2.1 Awareness of the Container Size Proliferation Problem

A. Manufacturers

Distribution executives in manufacturing firms interviewed had quite diverse levels of awareness of the shipping container proliferation problem. The general level of awareness and alternative problem sources identified are discussed below.

1. General Awareness. Interviewee responses ranged from a total lack of appreciation of the problem of container size diversity to an in-depth knowledge of the impact of the proliferation of sizes for distributors' operations. In general, the level of awareness was correlated with firm size. Larger companies tended to have more sophisticated managers more attuned to the customer service aspect of their business. Thus, these managers were more familiar with customers' complaints about packaging. Also, several respondents from the largest firms in the sample

had worked on joint industry committees on distribution including the 1974 study of modularization by the NAFC.

Representatives of smaller firms in the sample were less aware that shipping container size proliferation was a problem. Several interviewees reacted to questions about the size proliferation by saying that retail packages, case packs, or shipping container sizes were already standardized for the categories or family groups in which they sold their products. Thus, these respondents exhibited a lack of awareness of the problems which emerge when different product categories are inter-mixed in distributors' operations.

2. Alternative Problem Sources. Respondents also identified two alternative sources for the poor performance of the food distribution industry. First, several manufacturers believed that a more basic problem was that the standard unit load base (48 by 40 inches) did not fit the transportation vehicle sizes used in the U.S. In order to better occupy vehicles, suppliers over-design their unit loads to extend over pallets. The better fit means that damage is reduced in manufacturers transportation equipment. However, in distributors' warehouses pallet "overhang" creates handling difficulties and has been identified as a major cause of product damage and loss. Second, some manufacturers held the view that wholesaler and retail chain firms' difficulties in distribution often blamed on inadequate packaging were more the result of ineffective management. One respondent thought the true source of productivity problems was the inability of distributors to manage their own work force. This person did acknowledge that some improvement was being made through the application of labor standards and incentive systems. Another interviewee voiced the opinion that the work force and substandard

packaging were part of the problem. A study undertaken by this firm of damage in a distributor's warehouse described workers as "generally unskilled, poorly educated, unmotivated and highly paid." Management flexibility was described as being limited due to work assignments and rules governed by union contracts. Supervision was pointed to as often being a problem. In addition to several packaging inadequacies, the study identified the lack of training or concern of employees as a major cause of damage. Thus, some manufacturers see package improvements as only a part of the solution needed to improve performance in distributors' operations.

B. Distributors

The general awareness of distribution and procurement managers in wholesale/retail firms is discussed below. Alternative problem sources identified are also presented.

1. General Awareness. Distribution managers interviewed almost universally had an acute awareness of the effects of shipping container size diversity. No interviewee knew precisely the number of different sizes, but several estimated this number. The problem of sizes was most frequently discussed in three contexts. First, complaints were made about the unit loads which extended over the pallet base, thereby creating damage and loss. Second, the dampening effect of container size diversity upon labor productivity in building unit loads of different products was frequently cited. In fact, several distributors had designed the layout of their warehouse so as to locate products with similar heights near one another to improve productivity. Third, case size was

brought up as a limiting factor in the operation of existing automated/ mechanized facilities and in the development of new technologies.

Buyers, in contrast to distribution managers interviewed, had a different level of awareness and concern for the proliferation of sizes and its effects. Buyers generally were less aware of the problem. Several respondents indicated that case size had never come up as an issue in their transactions with suppliers. Buyers also tended to view the size issue as being "narrow" in that it ignored the reason for all those sizes--the consumer.

2. Alternative Problem Sources. Several alternative problem sources than case size diversity were brought out during the interviews. First, shipping package quality was identified by distribution managers as being in many cases a more pressing problem than size proliferation. Several buyers interviewed were also aware of the package quality problem. Respondents, particularly those with mechanized/automated facilities, indicated that new package materials such as plastic wrap over trays were an important problem. Third, several distributor respondents acknowledged that part of the problem, particularly with respect to damage in warehouses, was due to mishandling by workers.

6.2.2 Awareness and Understanding of Modular Packaging

Food system participants' knowledge of modular packaging was probed in the interview process. Observations about manufacturers' and suppliers' awareness and understanding of the modular concept are presented below.

A. Manufacturers

All interviewees were familiar with the term modular packaging. However, several different interpretations of the concept were found to exist.

1. Industry-Wide Modularization. Representatives of the largest firms generally understood modularization to be the industry-wide standardization of containers which was defined in Chapter 4. The only reference to how many sizes would exist in such a container system was the 180 sizes specified in the A.D. Little study conducted in 1974. Several respondents further interpreted modularization to mean precise sizes with no or little tolerances for containers or the unit load.

2. Manufacturers' Modular Mixed Loads. Many manufacturers allow the ordering and delivery of layer quantity combinations of different products to form a mixed unit load. The ordering procedures for one manufacturer are shown in Exhibit 6.1. Suppliers are also promoting these loads as a way to reduce warehousing costs by eliminating order selecting costs or, if the load bypasses the warehouse and is shipped directly to the store, to eliminate warehousing costs. Several manufacturers interviewed referred to these mixed layer units of their own products as modular loads.

3. Improved Unitization of Manufacturers' Products. Another interpretation of modularization which surfaced in the interviews was that of improved unitization of products on the standard 48 by 40 inch pallet base. For instance, if containers could be precise modules of the unit load base, then voids between packages (see Figure 5.3) could be reduced, adding to space utilization and load stability. Another respondent

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ORDERING PROCEDURES

3. Mixed Unit Ordering Option

To provide ordering flexibility, certain products may be ordered in layer quantity combinations to create a mixed unit load. Please Note: Full unit load ordering is the preferred method because it minimizes shipping and unloading damage, reduces overages/shortages, and improves unloading productivity.

The same guidelines for carload, pick-ups, and truckloads apply to orders calling for mixed units. The mixed units must comply with the following additional guidelines:

a. A unit load must consist of products from within one grouping as specified below. For example, items in Group "A" may be mixed with other items in Group "A", but Group "A" items may not be mixed with Group "B", "C", etc., items on the same unit load.

b. Products may not be mixed on a single layer.

c. All layer quantities must be combined into a mixed unit load. The total unit loads ordered may not exceed ordering guidelines.

d. Unit/layer product groupings:

Group A

Items in Group "A" below may be ordered in any combination to equal, but not exceed five layers per unit.

UPC	Product/Description	Layer Qty.
		15
		15
		10
		19
		10
		10
		19
		10
		19

Source: Obtained through a personal interview with a major U.S. food manufacturer.

Exhibit 6.1 Example of Ordering Procedures for Manufacturers Mixed Modular Loads

broadly defined modular packages to be packages which fit with no "overhang" or "underhang" on a defined unit load base.

B. Distributors

Most distribution managers in wholesale and retail firms were somewhat familiar with the modular concept. As with manufacturers, distributor respondents had different interpretations of the concept. Buyers interviewed were not familiar with the industry-wide modular concept, although they were quite aware of manufacturers' "modular" mixed loads by layer.

1. Industry-Wide Modularization. The majority of distribution managers interivewed generally understood modularization to mean the industry-wide standardization of shipping containers so that the resultant sizes were geometrically related. Respondents indicated they had become aware of the concept through trade association (e.g., NAWGA, FMI) meetings, the trade press, and to a large degree, the work on Project M.U.M. in the fresh produce industry.

While the concept of modularization was understood, interpretations of how it would be operationalized into specific sizes differed drastically. One respondent believed that the 15 to 20 modules would exist in such a system. Most other estimates of the number of modular sizes were higher and ranged from 70 to 300. Several distribution managers and buyers interviewed raised the question of: How many and what would the standard sizes be? A distribution executive for a leading retail chain believed that the concept was clear to most people in the industry, yet the fact that no concensus had ever been developed about permissible overhang or

specific modules resulted in some lack of clarity about what modularization would entail.

2. Manufacturers' Modular Mixed Loads. Several distribution managers and most buyers interviewed were familiar with manufacturers' "modular" loads. Distribution managers perceived the prebuilding of unit loads which need only minor warehouse handling (e.g., being moved only across a dock) as an opportunity to reduce distribution costs. Two respondents estimated that it cost one-third less to handle these loads than the typical product through the warehouse.

Buyers were very familiar with manufacturers so-called "modular deals." Several buyers indicated that while such mixed product loads were effective in lowering warehousing costs, they were not workable for most stores on a day-to-day basis since more product was delivered to the retail level than necessary. Such loads were used for fast-selling items on special or for large high volume stores. A respondent believed that manufacturers used modular loads to "force" products to the retail level to enhance their market position.

3. Modularization as a Broad Term Referring to Package Improvements. It became apparent that some distributors had a broader meaning than the industry-wide standardization of sizes defined in Chapter 4. Distribution managers often used modularization to mean resolving the entire array of interrelated package problems including package quality and materials, pallet "overhang" and "underhang" and case sizes.

6.2.3 Information on the Effects of Modular Packaging

A. Manufacturers

Manufacturers' representatives were questioned about the potential effects of package modularization upon the food manufacturing and distribution operations in their firms as well as distributors. The cost of retooling equipment to make the change was a common response. Interviewees also identified savings possible through increased simplification. Of 15 respondents questioned on manufacturing effects, 11 individuals identified potential savings, three indicated that no significant savings existed for their firm, and the remaining respondent was uncertain if benefits would result. Observations about interviewees' responses are presented below. Some distribution managers commented on benefits to distributors. Reduced damage and increased warehouse mechanization/automation potential were frequently cited as benefit areas. Two respondents familiar with the 1974 A.D. Little study of modularization stated that the results were inconclusive. A third indicated that the study documented the fact that modularization benefits were not substantial.

1. Insignificant Savings Potential. Distribution managers in three manufacturing firms in the sample held the view that no significant savings existed for their firms from modular packaging. These individuals' comments emphasized the cost of conversion and the fact the price of their products would have to be increased. It is possible that the respondents were making a net benefit calculation (deducting conversion costs or marketing effects) to arrive at the conclusion of no significant savings.

2. Potential for Savings to Manufacturers. Eleven respondents identified savings for their firms from greater standardization of shipping container sizes. In Table 6.1, the frequency with which four areas of savings were mentioned is presented. First, respondents identified packaging procurement savings through simplification of administrative work associated with the numerous sizes. Another savings area was that of volume discounts through larger purchases with one supplier. Second, savings in the storage and costs of holding packaging inventory was identified as a benefit of standardization. Respondents indicated that fewer container sizes would mean that smaller quantities of package material need be on hand, thereby reducing required storage space and costs of inventory. Third, interviewees identified potential savings in production and packaging operations due to an ability to use more common packaging lines for different products. Thus, packaging equipment changeovers and downtime would be reduced and efficiency increased. Fourth, and most frequently mentioned, was standardization savings in manufacturers' distribution operations. Increased productivity of labor and materials handling equipment in warehouses was cited as a benefit. Standard sizes were predicted to lead to fewer pallet patterns which would, in turn, simplify automatic palletizing (load building) equipment and create opportunities for automating products now manually handled. Interviewees stated that standard modular sizes which precisely fit onto pallets and were more stable would reduce damage in their warehouses. Also, since voids in pallet patterns would be reduced or eliminated and unit load heights would be similar, respondents indicated that warehousing and transportation space utilization would be increased. Several interviewees believed that savings would be realized by combining different products

Table 6.1 Areas of Savings From Shipping Container Standardization in Manufacturing Firms Identified by Supplier Distribution Managers

	Number of Firms Identifying*
A. Distribution Operations	10
1. Warehouse and/or Transport Space Utilization (8)	
2. Damage Reduction (6)	
3. Productivity in Material Handling (4)	
4. Greater Ability to Mix Different Products of a Manufacturers' Product Line (4)	
B. Production and Packaging Operations	8
C. Storage and Inventory Costs	4
D. Procurement of Packaging	3
E. Other	1
1. Productivity in Handling Inputs (1)	

*Fifteen firms were questioned regarding manufacturing impacts. The total exceeds 15 since most firms identified savings in more than one area.

into mixed unit loads. One distribution manager identified potential savings in handling the inputs used as ingredients if these containers were standardized.

Distribution managers identifying the above areas qualified their remarks in several ways. They stated that achieving these savings were subject to marketing objectives and competitive conditions. For instance, much emphasis was placed on the retail package's importance in attracting consumers and competitive reasons for offering various sizes. One executive interviewed said that his distribution instincts told him that standardization was like "manna from heaven" and that gross savings were available to any firm handling various products. However, since he had some sales experience, he understood the broader picture. Savings from standardization were also pointed out to be subject to the individualized product's characteristics, such as density or raw product shape.

3. Case Studies. Three firms in the manufacturing sample had studied or implemented programs to standardize the secondary and/or primary packages with the objectives of improving manufacturing or distribution productivity. One firm had conducted a study of standardizing glass jar diameters into an optimum size. It found tremendous benefits in manufacturing and handling in glass package vendors operations and within its own firm in the areas of package labeling and case packing, palletizing of products into unit loads, and increased warehouse space utilization. The program was not implemented due to concerns about extra weight of the glass, performance of jars in production operations and their aesthetic appeal to consumers.

A second firm had a task force studying possible shipping container design changes and standards in order to better use the cube of a unit

load and more effectively utilize materials handling and transportation equipment. Because of marketing reasons, no changes in retail package dimensions were being considered. However, the task force was exploring the variable of case pack to improve handling efficiencies in the firm. Resistance to making changes in this variable was being encountered from the production part of the company due to interruptions in the production process that would lower that department's productivity.

A third company included in the sample had undertaken a program to reduce the number of retail and shipping packages for a major category of its products. Significant potential savings were estimated in four major areas. First, plant operations would be enhanced through reduced packaging line changeovers and improved line productivity. Also, savings were estimated through reduced package material inventories and improved utilization of package materials. Second, warehouse savings would be provided through reduced inventories and improved space use. Third, savings would accrue in the transportation system from increased loading/unloading productivity and enhanced vehicle utilization. Finally, damage would be reduced. As a result of this study, the standardization program was undertaken and many of the savings were realized. However, a respondent indicated that while hard dollars and cents savings were realized, implementation difficulties occurred because of marketing and sales factors. Even though distributors benefitted from the program, the interviewee indicated that many were not receptive to the change and that as a result sales may have suffered. A general resistance to change on the part of distributors was found to be a major part of the implementation problem. The interviewee pointed out that, in general, it was difficult to sell productivity enhancing innovations to distributors. Thus, while

this program produced hard savings for the firm, the net effect on its market position may not have been positive.

B. Distributors

Distribution managers in wholesale and retail chain firms were questioned regarding their knowledge of the probable effects of modularization. None of the managers interviewed cited savings estimates from the 1974 A.D. Little study. Respondents were generally aware that modularization had been discussed in joint trade association meetings, but only one interviewee was familiar with the 1974 study. This individual indicated that while the study found fairly significant advantages from modularization, the results were not greeted with much enthusiasm by the industry since the relationships with manufacturers and retail merchandisers/procurement people needed for implementation had not been developed. Several respondents noted that there was a general lack of awareness of the benefits of modularization in the industry and traced this problem to a failure to quantify its impacts and disseminate this information. These barriers are discussed further in Chapter 7.

Interviewees were asked to predict the impact of modular packaging upon their firm's operations or upon other stages in the food distribution system. The major categories of responses are presented in Table 6.2. Of the nine categories identified, all but two are in the area of warehousing and transportation. A brief description of and some observations about the responses are below.

1. Warehouse Labor Productivity. Increases in the productivity of labor was the most frequently cited benefit. Improved handling was expected in receiving, order selecting, load assembly and truck loading.

Table 6.2 Areas of Savings Identified by Distribution Managers in Wholesale and Retail Firms

	Number of Firms Identifying*
1. Warehouse Labor Productivity	25
2. Improved Utilization of Truck Space	23
3. Reduced Damage in Warehousing and Transportation	22
4. Increased Automation/Mechanization Potential	18
5. Improved Utilization of Warehouse Space	8
6. Retail Store Level	9
7. Reduction in Tape/Stretch Wrap for Utilizing Outbound Loads	7
8. Reduced Training Time for Order Selectors	3
9. Manufacturing Level	2

*Thirty-seven firms were interviewed. The total exceeds 37 since most firms identified more than one savings area.

Most respondents emphasized faster order selection and less product re-handling in the load assembly process. Several interviewees believed that savings existed in this area, but that they were not substantial. An executive for a national chain estimated that modularization would reduce his firm's labor requirements by about 2 percent amounting to slightly more than a million dollars annually in savings.

2. Improved Utilization of Truck Space. The second most often cited savings area was that of increased space use in truck trailers. The ability to effectively intermix modular cases and build loads to a greater height was estimated to increase space use in transport carriers from 5 to 30 percent. One respondent estimated savings of 10 percent would provide his firm savings of 2,400 dollars per day or roughly $600,000 per year. Four regional retail chain representatives acknowledge the potential savings, but indicated that their firm was not interested in these savings. Respondents stated that they were more interested in maximizing service to their retail stores than effectively utilizing the space in each vehicle. The relatively short trips involved was also pointed out to be a factor.

3. Reduced Damage in Warehousing and Transportation. The third most frequently identified savings area was that of damage reduction. Warehouse damage was predicted to decrease because of reduced pallet overhang and increased load stability in receiving and moving products to storage slots. Also, respondents believed damage would be reduced in the order selection process and in transport of products to the retail store. While many interviewees felt that damage reduction was possibly the largest area of savings, they also stated that it was the most

difficult to quantify because of the myriad factors influencing product damage.

4. Increased Automation and Mechanization Potential. The fourth most frequently identified savings area was the increased potential for further automation and mechanization of warehouse operations. Use of automatic equipment or robotics in the load assembly process in existing systems was described as a feasible opportunity if packages could be standardized. Several respondents stressed standards would permit the development of "blue sky" technologies. Also, modular package sizes were pointed out to have the potential to improve the operation of existing automated (vending machine) order selection equipment, mechanized (pick-to-belt conveyorized) systems, and automatic storage and retrieval equipment (stacker cranes). The potential benefits in automation/mechanization were stressed by individuals from firms operating these warehouse types as well as conventional systems. Several managers of conventional warehouses believed that greater benefits would accrue to firms with automated/mechanized systems.

5. Retail Store Level. Interviewees in nine firms identified potential savings in truck unloading, backroom storage and/or handling and in-store handling and shelf-stocking. The damage reduction potential of modularization was emphasized by several respondents.

6. Improved Utilization of Warehouse Space. Eight firms identified benefits in the use of warehouse space. Most comments pointed to increased storage capacity due to reduced pallet overhang and more predictable unit load heights. A respondent indicated that racks would need to be changed less frequently. An executive for a retail chain firm

estimated that warehouse space requirements could be reduced by 10 percent. He added that this benefit was probably not recognized in the industry.

7. Reduction in Tape/Stretch Wrap for Unitizing Outbound Loads. Seven respondents felt that the stability afforded by modular cases would reduce the materials needed to hold together a load of different products during transport to the retail level. No interviewee expected that these materials would be entirely eliminated with modularization.

8. Reduced Training Time for Order Selectors. Three interviewees predicted that the implementation of modular packaging would decrease the amount of time needed for workers to become proficient at order selecting. One executive stated that selecting orders with all the current case sizes is an art and it takes six months for a selector to learn how to "pick smart" in order to get a high cube pallet load. This individual indicated that modularization would provide substantial benefits by reducing the time needed to train people.

9. Manufacturing Level. Respondents from two firms indicated that manufacturers would receive benefits from modularization. Increased utilization of transportation vehicle space was identified as a potential savings area for manufacturers. Also, one interviewee expected that manufacturers would be able to achieve greater efficiencies in their plants.

6.3 Chapter Summary

Findings from the literature review and personal interviews relating to participants' knowledge of the modular concept and its effects

were presented in this chapter. Evidence from the literature review suggested that: 1) awareness of modularization may or may not be a problem; 2) participants had different interpretations of its operationalization; and 3) the lack of information on total or net system costs was perceived as a problem for implementation. Personal interviews with manufacturer representatives revealed that: 1) a wide range of awareness levels existed for shipping container size problems and modularization; 2) they perceived alternative sources of distributors' productivity problems than packaging; 3) they were aware of the term modular packaging, but had different interpretations of it; 4) the majority of distribution managers interviewed identified savings from package standardization and modularization for their firm; and 5) one firm had implemented a program to reduce the number of retail and shipping packages used and had realized significant plant, warehouse, transportation and damage savings. Interviews with distribution managers in wholesale and retail firms indicated that: 1) they were acutely aware of shipping container size proliferation problems; 2) they were aware of other problem sources (e.g., package quality, labor mishandling) than case size diversity; 3) managers were familiar with the modular concept, but interpreted it differently; and 4) they identified numerous potential savings opportunities from modular packaging.

Four observations regarding the results of the chapter can be made. First, participants interviewed are generally aware of the term modular packaging. Second, participants have different interpretations of the modular concept and how it would be operationalized. Third, participants are generally unaware of the limited quantitative work on modularization that has been done. Finally, distribution managers in both manufacturer

and distributor firms predict savings from modularization for their firms.

CHAPTER 6

FOOTNOTES

[1]U.S. General Accounting Office, Redesigning Shipping Containers to Reduce Food Costs, CED-78-81, Washington, D.C. (April 1978), pp. 48-50.

[2]National Commission on Productivity, Annual Report (1975), p. 27.

[3]DeWayne Whitehead, "Modularized Packaging and Productivity," paper presented at the 1976 National Packaging Week Assembly, Chicago, IL (October 1976), p. 5.

[4]Donald J. Bowersox and Robert J. Monczka, Perceived Impact of Federal Laws and/or Regulations on Productivity Innovation in the Food Industry: A Fact Finding Study, Report to the National Center for Productivity and the Quality of Working Life (June 1978), p. 23.

[5]Gordon F. Bloom, "Improving the Performance of the Food Distribution Industry," Journal of Food Distribution Research (July 1973), p. 15.

[6]DeWayne Whitehead, "Modularized Packaging...," p. 5.

[7]U.S. General Accounting Office, Redesigning Shipping Containers ..., p. 13.

[8]Ibid., pp. 48-51.

[9]Alan L. Haberman, "Standardized Case From the Retailer's Viewpoint - Efficiency of Handling, Faster Storage and Withdrawals, In-Store Merchandising Uses: Problems to be Solved," paper presented at the 1975 National Packaging Week Assembly, New York (October 1975), p. 7.

[10]Gordon F. Bloom, Productivity in the Food Industry: Problems and Potential, Cambridge: Massachusetts Institute of Technology Press (1972), p. 141.

[11]A.D. Little, Inc., An Examination of the Effect of Modularization of Secondary Containers on Productivity in Grocery Distribution, Report to the National Association of Food Chains (August 1974), p. 5.

[12]Alan L. Haberman, "Standardized Case From the Retailer's Viewpoint...," p. 7.

[13]U.S. General Accounting Office, Redesigning Shipping Containers ..., p. 76.

[14]Thomas R. Pierson, John W. Allen, and Edward W. McLaughlin, Dry Grocery Losses, Michigan State University Agricultural Economics Report No. 427 (December 1982), pp. 28, 30, 32.

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CHAPTER 7

INSTITUTIONAL BARRIERS TO THE ADOPTION OF MODULAR PACKAGING

A broad array of institutional barriers identified in this research effort are presented in this chapter. Institutions, in the sense used here, refer to the system of formal or informal rules which define opportunities and constraints for individuals and groups in a society. In other terms, institutions determine what participants do and do not have to take into account when making decisions. In short, the institutional structure sets the "rules of the game" for transactions in the economic and political arena. This structure consists of laws, regulations, property rights, customs and roles.

In light of the above, institutional barriers to a particular change can be discussed. Available evidence indicates that modularization would improve certain dimensions of performance of the U.S. food system. Institutional barriers to modular packaging are thus the particular elements of the institutional structure which do not provide the incentives to participants to utilize modular packaging. Institutional barriers might be better termed "institutional failures" since they are instances where current institutions are not working to yield the performance desired of the system.

This chapter focuses on institutional barriers to modularization. However, a much broader range of variables are covered in the analysis since institutional barriers are the composite result of the interaction

of characteristics of the environment and specific goods, participants and their attitudes and behaviors, and the institutional structure. Results from the literature review are first presented and followed by data acquired through interviews.

7.1 Literature Review Results

Institutional barriers identified via the literature review were classified into seven categories. The factors within each category are elaborated upon below.

7.1.1 Institutions vs. Technology as an Impediment to Improved Performance

A number of articles reviewed cast greater light upon the nature of changes needed to improve the functioning of the physical distribution system for food in the U.S. One of the basic questions addressed was whether technological or institutional changes were necessary to improve productivity. Several experts' views on this issue included the following:

> However, in the area of distribution,...the need is not so much for new technology as for application of technology which is already known. The problem is one of systemization and implementation, rather than one of invention.[1]

> While we know more science and technology than ever before, we are using it less--less, that is, as weighed against the increased overall potential....The bottleneck lies in the arrangement making; the organization of team effort among government, private enterprise, and science and technology.[2]

Several additional views concur with above regarding technology, institutions and productivity. R. Harrison, president of Fleming Company (the nation's second largest wholesaler), expressed his "impatience, frustration, and dissatisfaction" with the degree to which available knowledge and technology have been applied to improve productivity in

the food industry.[3] A task force studying productivity concluded that only a very small fraction of technological innovations in the food industry require a high degree of technology. This study emphasized that the major barriers to such innovations are in the weak incentives which exist for individual firms to take action to implement innovations because the full benefit of such action could not be captured by that firm.[4] The task force report cautions that when such barriers are found, they should not be interpreted as being the result of any participant's effort to thwart improvements for their own benefit. Rather they "are primarily the result of institutions not changing rapidly enough to meet the changing times, or where the consumers' ultimate best interests are not clearly seen in the context of the individual firms or farmers operations."[5]

In sum, a number of food industry observers and leaders believe that improved food industry productivity and performance is, more often than not, constrained by institutional not technological factors. Thus, a critical research activity is identification of these barriers and the design of institutions which encourage the adoption of innovations likely to improve performance. As Bloom states:

> The key question is whether or not means can be devised to implement improvements in distribution which overall systems analysis indicates will improve productivity.[6]

7.1.2 Benefit and Cost Incidence

System-wide innovations, such as modular packaging, require concerted action by participants throughout an industry to improve overall performance. Implementing such changes generally involve costs, at least in the short-run, for some industry sectors. Such negatively impacted sectors are likely to be reluctant to change to provide

benefits for other industry segments and the total system and consequently such innovations may be difficult to obtain even over an extensive time period.[7] Thus, the incidence of benefits and costs can be a critical factor influencing the adoption of modular containers. Impact incidence itself is not the institutional barrier. These barriers are the features of the existing institutional structure which do provide a mechanism for "winning" sectors to compensate "losing" sectors and thereby create incentives for adoption.

A. Vertical Incidence of Effects

A barrier to modular package implementation often cited in the literature is the uneven distribution of benefits and costs among industries.[8,9,10] Manufacturers, who will receive some benefits, will incur the costs of implementation whereas distributors will reap most of the benefits from modularization. The major cost areas to manufacturers identified are physical conversion costs, restrictions on technological innovation, and impacts on marketing.

The majority of manufacturers and distributors surveyed in 1978 identified the costs of implementation to manufacturers as a primary obstacle to modularization.[11] The conversion cost barrier surfaced in the trade literature in several instances. Examples include:

> Following last years report on modular packaging, the GMA board decided it would study implementation costs and decide what, if any, steps it would take. It declined the help of retailers on the basis that the costs incurred would be borne solely by manufacturers. While no official report was ever made public, it was understood that NAFC was handed a flat turndown on any movement aimed at modular packaging.[12]

> Retailer and wholesaler requests (for modularization) over the past two or three years have been steadily resisted by manufacturers who contend that packaging machinery costs to revamp the current system would cripple that industry.[13]

Haberman, who chaired the NAFC Productivity Council overseeing the UPC and modularization projects, addressed the conversion cost issue in a 1975 speech. He pointed to the fact that modularization would damage current packaging investments and that the grocery manufacturing and packaging industries were the key vested interests. He also questioned whether the cost would be major or minor and recommended that the flexibility of packaging machinery be studied and standards be developed which were responsive to this problem. He urged that such costs be minimized by implementing modular sizes in conjunction with normal package changes.[14]

A second cost obstacle frequently cited is the possible stifling of technological change by inflexible standard container sizes.[15,16] Concerns that standardization would inhibit technological change may not be limited to grocery manufacturers and packaging firms. For example, Bloom notes:

> To executives throughout the food industry, it (standardization) raises a fear of a system which might provide short-run advantages but in the long-run, like the building codes and zoning laws in the construction industry, would stifle a business where change and variety have been the keystones to growth.[17]

Reintjes in a study of the application of technology to the food industry, also expressed concern that "freezing" container sizes could have repercussions for use of warehousing technology not yet conceived.[18] Bloom concludes that standards should be carefully designed so as not to constrain technological change and a mechanism be devised for orderly review and amendment of the standards.[19]

The most commonly mentioned cost obstacle was that of the potential impact of modularization on marketing. This effect will depend on the

degree to which retail packaging is affected. If only the case count is changed, these effects will be minor. For example, fewer retail packages per case may increase the frequency that a manufacturer's product is out of stock on retail shelves, thereby hurting sales. However, the issue of negative marketing impacts has come up most frequently in relation to modularizations effect on the retail package.

The importance of this barrier is recognized when the role of packaging is understood. The following comments shed light on why a modularization program which affects retail packaging will meet resistance.

> Freedom to change package size is an extension of the right to vary the product, the latter has long been viewed as an essential, even an unalienable component of the marketing mix.[20]

> The product manager represents the most important obstacle to modularization....The grocery industry is very primary package oriented. It is the silent salesman. A marketing man must be free to do his job so as to keep his space on the shelf, to expose his individuality, to tell his story. To confine him in any way is to attack the entire system of distribution. To attack in this area, especially in the framework of voluntarism, is to have the idea of modularization rejected.[21]

The basic orientation of the grocery marketing system to creating variations in product and package has been identified as a fundamental barrier to modularization.[22,23]

In addition to the potential effect on attractiveness of products to consumers, retail package standardization could change the nature of competition in the grocery industry. Standardized retail package sizes and product quantities may reduce manufacturers' ability to compete by varying package sizes.[24] Competition may shift from non-price product attributes to price weakening consumer loyalty. Also, standard sizes would limit manufacturers flexibility to "downside" products when input

costs rise so as to keep the items price from reaching psychological barrier levels where consumers purchases decline.[25]

Marketing considerations were also identified as a barrier in the sense that standard sizes would limit consumer choice and weaken manufacturers' ability to satisfy consumer desires.[26,27] This impact is dealt with in greater detail in Section C on consumer impacts below.

B. Horizontal Incidence of Effects

The benefit and costs from modularization may be quite different for firms within a particular horizontal level of the industry. Since widespread participant action is needed for implementing industry-wide change, any participant group that perceives it will bear disproportionate costs or receive few benefits will be unwilling to act for such change. The NCOP, emphasizing the need for equity to foment system-wide change, stated that "each interest group will be willing to sacrifice only to the extent that others do, and each will require that its long-term position improve."[28] Also, if one interest group perceives the change will provide greater benefits to another group within its horizontal level (a competitor), it will not be likely to support the change.

Concerns have been raised that smaller manufacturers may be placed at a disadvantage relative to larger manufacturers. First, if retail packages are affected and conversion costs are high, smaller firms may be less able to withstand these costs.[29] Second, the elimination of odd-sized packages and case packs, which are frequently produced by small manufacturers, may force these firms to compete with larger manufacturers. Standardization should facilitate volume production which usually confers advantages to larger firms. The longer run result may be that higher cost small manufacturers may close down, reducing firm

numbers and competition in food manufacturing.[30] On the benefit side, small manufacturers' products may receive greater handling cost savings than big suppliers' items. For example, A. Hillhouse, a distribution executive at A&P, predicts that 85 percent of all items that sell less than one case per week (slow movers) would benefit most from modularization.[31] To the extent that smaller firms with limited promotional capacity produce such items, they will receive a greater proportion of benefits from modularization than bigger firms.

Modularization could produce differential impacts on manufacturers for other reasons. First, if modularization is done gradually to minimize conversion costs, the initial firms may put themselves at a marketing disadvantage. For example, modular sizes might require changing the retail package so as to reduce retail shelf facing possibly leading to reduced sales for that firm.[32] Manufacturers have cited numerous instances where they have attempted to reduce their materials costs by shrinking package size, but the end result was an erosion of a firm's market position.[33,34] If all firms competing in a product category simultaneously modularize their packages, firms would be equally affected by modularization and this problem would not occur. However, the potential exists that some product categories may receive improved shelf space display and thus improve their relative position. A second possible obstacle may arise in that standards developed may be closer to some firms' current sizes, creating fewer cost disadvantages to these firms relative to others.[35] Thus, the process of standard setting implicitly is one of allocating conversion costs to firms. Thus, substantial conflict and disagreement may occur over the proper standard.

Modularization could produce differential impacts on the distributor side of the business. For instance, a modular program based on the 48 by 40 inch pallet would create extra costs for wholesalers which use smaller pallets internally by forcing them to carry extra inventory and change warehouse racking.[36,37] Conversely, some distributors may gain much more from modularization than others. Modular containers will be very beneficial to distributors with mechanized and automated warehouses. For instance, Table 5.4 indicates mechanized warehouses have the greatest savings potential of four warehouse types. Productivity increases in mechanized distributors operations should lower their costs and convey a cost advantage to these firms relative to firms using conventional methods.[38] If distributors using conventional facilities, which are in the majority (almost 90 percent of grocery cases are handled manually), perceive modular containers as being most beneficial to a select group, they are unlikely to actively support modular container adoption. Since mechanized distributors are perceived as already "ahead of the game," introducing a change which will benefit them more could meet strong opposition.

C. Consumer Impacts

The primary function of the food system is to provide the type and quantity of products that consumers most want. Manufacturers argue that the only reason that container sizes proliferate is to meet the needs of consumers.[39] Modularization of container sizes could affect the ability of the marketing system to meet consumer preferences. Second, if modularization leads to retail package standardization, elimination of sizes would limit variety and choice and possibly make consumers worse off.[40,41] Third, standardization of package size may result in more weight variation

among products of given type thereby adding to the difficulty of price comparison by consumers. Due to differences in product densities, standardization of package size would produce greater variation in product weights which are used in comparison purposes.[42,43] Unit pricing will eliminate this problem for consumers that use it.

D. Labor Impacts

System-wide innovations in the food industry often lead to methods which are more capital intensive and which reduce the amount of labor needed. Modular containers should make warehouse workers more productive and, thus, fewer workers needed in total labor requirements. Modularization will facilitate further warehouse mechanization and automation which could lead to large scale worker displacement. (However, employment will likely increase in materials handling supplier firms.) Thus, it is possible that labor unions, if they recognize the possible implications of modularization for labor, may at some point attempt to prevent the savings from modularization from being reaped. Labor opposition to other innovations (e.g., UPC and the elimination of price-marking) suggests that such behavior could be a potential obstacle to modularization.[43] However, no evidence on the view of labor toward modular container adoption was found in the literature review.

7.1.3 Modularization Benefits: Their Timing and Certainty

The benefits of modularization possess several attributes which could make modularization a less desirable goal from a firm's standpoint. This would be particularly true for large food industry firms, in which managers tend to be conservative and emphasize short run payback periods.[44]

A key attribute of modularization benefits, which is common to many industry-wide systems innovations, is that no one participant can benefit unless all or most of the rest also make the change. Consequently, no one player can change the system alone.[45] In the case of modularization, the realization of benefits by any distributor depends on some critical or threshold number of manufacturers adopting standard-size containers. There are at least two implications for modular container adoption. First, the benefits to distributors from efforts to further modularization may not accrue for a long period. For example, ten years has been estimated to be the minimum amount of time needed for significant modularization to be accomplished in the U.S.[46] In such situation, distributors may prefer to commit resources to activities promising faster return. Bloom pointing out some additional reasons for a delay in benefit response, makes a similar point regarding the industry as a whole:

> Furthermore the problem is so complex and a solution so remote in time that research funds are unlikely to be forthcoming from the industry.[47]

A second implication of this threshold is that benefits are less certain. No one knows what proportion of suppliers' products need be packaged in modular containers for distributors to begin realizing benefits. If the threshold is very high, then it is possible for even a few "hold out" suppliers to prevent any distributors from receiving benefits. The resultant uncertainty about benefits may further reduce the likelihood of distributor efforts to implement modularization. By the same token, manufacturers are unlikely to initiate a modular system unless there is some assurance that the system will be universally adopted.[48]

7.1.4 Lack of A Vertical System-Wide Management Perspective: Vertical Coordination Problems

The numerous vertical stages in the physical distribution system are owned by separate businesses which may have very different objectives and interests. No one firm spans the entire distribution system. Therefore, no one firm has a system-wide management perspective which is concerned with overall costs of the distribution system. In addition, no firm has the ability to control all of its component parts. As a consequence, a major barrier to system-wide innovations capable of lowering total system costs is that these changes are beyond the area of concern and control of any industry entity. This problem is stated succinctly in the following quotes:

> Because there is no single entity to analyze the total industry effect of individual decisions or to advocate decisions from that perspective, opportunities for cross sector coordination are rarely exploited.[49]

> Often innovations which would increase productivity for the entire industry are postponed because they are beyond the capacity of any one firm or any one segment of the industry to effectuate. Wholesalers' automated warehouses which must await the introduction of manufacturers' modular packaging and retailers' modular shelves is an example of this.[50]

As alluded to in the first quote, the issue of system-wide change centers around improved coordination between sectors in the vertical marketing system. Evidence indicates that independent decisions of firms at one stage to increase their productivity and those by firms in the next marketing stage to increase their productivity have often led to reduced productivity performance for the marketing channel as a whole. Thus, decisions made in a micro firm management perspective diverge from decisions made from a macro or "systems" management perspective. The root cause of this divergence is a lack of coordination between the vertical stages in the marketing chain.[51] An acute need has been expressed

for improved coordination and cooperation among industry segments in order to bring about the critical innovations which would improve overall system performance.[52,53,54]

The market mechanism is generally relied upon to coordinate firms' activities within the economy. The market's ability to coordinate highly interdependent activities in a vertical marketing channel and create incentives for industry-wide change can be limited in some instances as noted in the following:

> Although market forces inspire technical change, some (fragmented) industries need a better coordination mechanism to carry it out.[55]
>
> But the profit incentive does not always lead to productivity gains when activities are shared among individuals and firms. As our economy becomes more interdependent, it is increasingly difficult to achieve the potential productivity benefits available throughout the entire manufacturing and service reporting system.[56]

Several problems with the market as an interfirm coordination mechanism are presented below. Intrafirm coordination problems are then addressed.

A. Market (Interfirm) Coordination

In an interdependent vertical marketing system, actions taken by one firm have impacts on other participants. Property rights define what effects are internal to the decision maker and have to be taken into account and those which are external to the decision maker and need not be considered. There is some evidence to indicate that such "external effects" commonly occur in the food industry and that they impede the system-wide coordination needed for improved performance of the system as a whole. F. Bloom argues that food industry managers "have ignored the effects of their actions on other units within the industry and the system as a whole"[57] resulting in considerable waste in the aggregate.

According to distributors, manufacturers package design decisions do not consider the impacts on distributor firms' operations. Two samples of distributors' views are below:

> Manufacturers know these problems (pallet overhang) exist. But they still design packages that need unusual precautions.[58]

> One of my greatest fears is that vendors will make changes without consulting retailers and wholesalers...They don't seem to be concerned with the end user...At least the manufacturers could warn us when they change (packaging) so we could watch it go through the system.[59]

Since the effects of a manufacturer's packaging decisions raise distributors' costs and, ultimately, the manufacturer's product price to the consumer, it would seem that suppliers would have an adequate incentive to improve packaging. However, some incidence indicates that the potential market signal is being short circuited. Pierson, et al., identified the following shortcoming of the price mechanism in creating incentives to reduce food losses:

> In general, products are priced to reflect costs incurred. This system should provide manufacturers with the economic incentive to reduce damage to their products. But some allowances and cash refunds granted cover only 15-20 percent of the total cost of damage borne by retailers, manufacturers may lack incentive to improve packaging to the extent warranted.[60]

The authors conclude that economic signals being transmitted to manufacturers may be incomplete resulting in no pressure on suppliers to reduce packaging-related damage.

There are several possible reasons for the market's inability to bring the necessary information and incentives for packaging improvements to manufacturers. First, the nature of competition may be such that wholesaler and retailers can pass on the costs of inadequate packaging. While competition does exist, the factors in other industries which typically restrain consumer price increases are not present to a large

degree in the food industry. Consequently, interest in major cost reduction efforts tends to be dissipated.[61] An example is the damage costs from improper or substandard packaging. These costs have been accepted by most in the industry as a "cost of doing business."[62] A probable reason that distributors have accepted this cost is that they have the ability to pass it on to consumers.

A second reason is that information on the actual cost of packaging inadequacies may not be known in distributor firms. Knowledge of actual distribution costs on an aggregate and an individual product basis are critical to generating incentives for package improvements. Aggregate cost data is useful to alert managers to the extent of these costs and to prompt action to reduce these costs. There is evidence that the actual costs of inadequate packaging are "hidden." For instance, a distribution executive made the following points concerning damage:

> ...for many distributors the real cost of damage is a hidden cost, which is camouflaged and counterbalanced by short shipments charged to stores. Unless special accounting controls are set up, this sizeable loss cannot be detected by controllers and top executives.[63]

Hidden damage spreads the cost of inadequate packaging across organizational and firm boundaries. Thus no one decision unit recognizes the magnitude of the total problem or deals with it effectively. Further, information about the particular packaging aspect that led to the damage is more difficult to obtain when the damage is passed to the retail level.

The knowledge of distribution costs on an individual product basis is a prerequisite for manufacturers to make package changes which could lower distributors' costs. For manufacturers to incur the costs of initiating these changes, some sort of reward or incentive is needed. In

many cases, the benefits of improved packaging in terms of reductions in damage-related costs would clearly exceed these initial costs, yet a problem arises. Grocery suppliers often view package improvements as costs that they may not be able to recover.[64] Thus, manufacturers believe that they will not be rewarded for package improvements.

The above statement appears paradoxical. Should not a manufacturer be interested in implementing a change that would reduce its product's cost and ultimate price to the consumer? In theory, lower prices and thus greater sales and profits would be sufficient rewards for manufacturers to initiate package improvements. In reality, the ability of the market mechanism to provide such incentives depends on its ability to provide accurate and complete information.

Available evidence indicates that an information transmittal problem is occurring at the distributor level. The general problem is illustrated in the following comment by a supermarket executive:

> Certain manufacturers have tried to help the retailer in various ways - backhauls, palletization, slipsheets, more services, return privileges, etc. Most of us do not factor these services into the cost of our merchandise. As a result, these manufacturers receive little or no benefit from this added cost to them. Many useful services therefore die aborning because the added cost was a competitive disadvantage to them.[65]

The quote above points to how failure to accurately allocate cost savings from manufacturers' changes to their products diminishes their willingness to make such changes. The standard information handling practices for allocating costs and reasons for them are discussed below.

> Food store operators do not know with any precision the handling and selling costs attached to each item sold in their stores, and accounting procedures do not attempt to break down the cost per item sold. These are estimated in the cost of markup. There is no method of determining the exact cost of handling a specific item; however, the most

> commonly used method is cost averaging. The cost of doing business varies with each store unit in terms of percentage of sales. A change in the rate of sales of any one item will affect the margin for the entire product mix. Thus, expenses are considered as a package and the total gross profit compared to the total expense.[66]

> Retailers told us that the use of gross margins by department, rather than computing margins for each item, is necessary because of the vast number of types and sizes of food products sold...They said that the time and paperwork needed to compute individual margins would be too great and too costly.[67]

The lack of individual product distribution cost information and the resultant imprecise allocation of such costs through averaging into product prices reduces or eliminates the incentive to a manufacturer to make package changes which would reduce handling costs for its product. Current cost allocation practices do not permit reductions in the handling costs of one particular product, such as those from better package design, to be directly reflected in the product's price. Rather the cost reduction lowers total costs and, if passed on, lowers the price of all products. This general reduction in costs benefits the manufacturer instituting the change in a small way and, more importantly, the reward is shared among all suppliers and does not improve the innovative supplier's position relative to other firms.

McKinsey and Company, a major consulting firm to the food industry, has analyzed this problem and drawn some implications for package improvements, including modularization. T. Wilson, of McKinsey, has stated that traditional retail pricing has involved adding a desired gross margin (which is rounded up or down depending on the item's sales position within a category) to the product's invoice costs. He stresses that this simplistic approach ignores a wide range of other factors influencing the costs and thus the profitability of an item. For instance,

primary and secondary packaging affect a product's handling costs such as the cube utilization in storage and shipment and susceptability to damage.[68] Thus, it is possible for two competing products to be priced the same even though one has considerably higher handling cost than the other. In this situation there is little incentive for the manufacturer supplying the product entailing higher costs to change packaging to lower those costs. For example, several paper manufacturers once introduced compressed facial tissues which conserved space and reduced distributors' costs but the products were not well received at retail. Wilson has pointed to pricing methods which did not reflect the handling and space savings in retail prices of the smaller packages as probable reason for the lack of consumer acceptance. He characterizes the nature of the problem and its more general implications in the following way:

> Grocery manufacturers and distributors do not share a common language. Manufacturers look at the industry in terms of product economics. Distributors think in terms of facilities and unit economics...[Therefore] discussion is limited on both industry-wide and operating actions may be taken which are at cross purposes. The incentives for manufacturers to reduce distributors' costs is weakened.[69]

In sum, distributors' imprecise cost allocation practices are a barrier to the transmittal of information and incentives required for manufacturers to make packaging improvements, such as reducing the number of sizes, which would lower distributors' costs. Current trends toward more accurate methods of cost accounting with the potential for eliminating this obstacle to modularization are discussed in Chapter 8.

B. Organizational (Intrafirm) Coordination

Transactions necessary to coordinate activities in the vertical marketing channel occur not only between but within firms. Consequently,

the effectiveness of intrafirm information communication has a definite impact on coordination in the channel as a whole.

Intrafirm communication has often been implied to be superior to interfirm communication via market mechanism for improving coordination and reducing system-wide costs. For example, several food industry leaders have recognized that decisions made by firms at one stage in their interest create effects on other industry stages cumulatively resulting in higher system costs. The common solution, at the conceptual level, to solving this problem of divergent interests acting at odds is to integrate (or extend the boundaries of the firm) to "internalize" the external effects. Communication is changed from interfirm to intrafirm. Thus, representatives of both the retail and manufacturing business have advocated that managers look at the entire food distribution system, from manufacturer to consumer, and ask how would the system be managed if it was all one business.[70,71] While integration has the intuitive appeal of greater rationality by introducing a broader management perspective, it overlooks the realities of how divergent interests are resolved, tradeoffs are made, and the mechanics of intrafirm communication. Some intrafirm coordination problems that act as barriers to package design improvements such as modularization are discussed below.

The basic intrafirm coordination problem is between the procurement and distribution functions in distributor firm organizations. The benefits of package improvements accrue in distribution (e.g., warehouse and transportation) operations of the firm. However, the mouthpiece of the organization, the part which interfaces with and communicates continually with manufacturers, is the buying department. Therefore, the ability of intrafirm communication to convey information about different products'

impact on distribution costs to buyers who communicate this information to vendors and bring about the package changes is crucial.

There is some evidence that the communication link between the buyer and distribution departments may be weak. L. Bowen a distribution executive for a regional wholesaler, has made the point that the "buyer usually has no functional responsibility for the warehouse, other than maintaining the proper inventory to meet retail demand" and the resultant communication gap prevents adoption of improved shipping methods such as unitization.[72] This physical and structural separation between these two functions has been identified as a major barrier to adoption of modular containers in the fresh product industry.[73]

The heart of the intraorganizational communication problem lies in the use of gross margin to evaluate buyer performance. The limitation of this criterion is that it fails to reflect the effect of buying decisions on warehousing costs. Increased margins from some product purchases may be more than offset by increases in warehousing costs. Kearney researchers reported the following to the NAFC:

> We noted a general hesitancy on the part of chain buyers to purchase products which cost more due to suppliers performing certain operations, such as trimming or wrapping, which would otherwise have to be performed by the distributor, many times at an even higher cost. Buyers indicated that since their performance is judged by the gross margin they produce, they don't like higher prices which reduce their margins - even though such purchases could increase the companies net operating profit.[74]

The jist of the above remarks were reiterated more recently by a chain executive who noted that distributors do not factor the lowered costs from manufacturers' efforts to assist them through various methods and services into their product's prices.[75,76]

While the above statement is couched in terms of manufacturers methods and services, other changes including package design have a similar effect. The change adds to a vendor's product price and thus reduces a buyer's gross margin for that product. The favorable effects of the package change in distribution could outweigh the initial added cost, but this cost savings would not enter into buyers' decision criteria. This particular problem has been cited by an executive for a major food distributor in the Netherlands, where modular packaging standards have been developed. He notes that implementation is "a matter of cooperation between the buying and distribution departments: a maximal profit margin is sometimes directly opposed to potential improvements in distribution."[77]

In sum, an important barrier to packaging improvements in general and thus modular containers is buyers' procurement practices which focus on gross margins to the exclusion of cost effects that occur elsewhere in the firm. This is a microcosm of the generalized "systems" problem in which individuals pursuing their interests separately result in greater costs for the system (i.e. firm) than if their actions were better coordinated. As was illustrated, coordination problems can arise in communications executed within the firm as well as across markets.

7.1.5 Horizontal Systems Barriers: Lack of Cooperation Between Competitors

The barriers described in this section are "systems" barriers in a horizontal sense. The basic "systems" problem is the same--micro-level decisions do not produce satisfactory macro results. However, the actors relation to one another and the coordination mechanism are entirely different than for vertical "systems" problems. The

interdependent parties are firms which compete against each other, accustomed to acting in their own interest vis a vis their competitors, not in the collective interest of the group. Coordination must be accomplished through some horizontal agreement, which is frowned upon by our anti-trust laws, but is to some extent possible through trade associations.

The origin of the horizontal "systems" barrier to modularization lies in the nature of the costs incurred and benefits received. As noted in Section 7.1.3, distributor benefits depend upon a critical proportion of manufacturers utilizing modular containers. No one supplier is able to produce benefits for a distributor. Only if many manufacturers cooperate to implement modular containers will there be any effect. For a manufacturer, the issue then is one of what are the benefits and costs of cooperating (assuming it is feasible within the legal structure, section 7.1.6 addresses legal barriers). The benefits of joint action will reduce the general level of costs for all suppliers but provide little or no advantage to one firm relative to any other. Consequently, the incentive to a manufacturer to introduce modular packaging is weak.[78] On the cost side, further disincentives to adoption are encountered. The costs of any cooperative endeavor must somehow be shared and how equitably it is shared will affect the willingness of participants to participate in the endeavor.[79] For instance, concerns have been expressed about the inequitability of cost advantages that would be conferred to an existing firm having sizes similar to standard modular sizes chosen. Agreement on sizes among suppliers will likely be a difficult process.[80] The time span of implementation is critical in a competitive environment in which marketing forces dominate. Some manufacturers believe that

modularization will negatively affect retail packages' marketability and that the first firms to change may suffer a competitive disadvantage. However, if all firms convert in unison to modular sizes, these firms do not see a problem.[81] Simultaneously adoption by all firms insures that any negative marketing effects will be shared equally. Uncertainty of general adoption is a closely related factor affecting firms' willingness to modularize their products.[82] For example, a firm contemplating modular packaging may be hesitant to initiate the system for fear that other firms will not follow. Being the "first kid on the block" could involve facing negative impacts to that firm vis a vis its competitors who may choose not to follow to further their own interests. Assurance that the system would be accepted universally would eliminate this implementation barrier.

The direct initial benefits of modular packaging primarily will accrue to distributors. Hence, the burden of initiating action to implement the change falls upon this industry segment. Unless distributors are willing to act to move the concept forward, manufacturers will not even consider adoption of modular containers for their products. As in the case of the effects on manufacturers, the nature of the incidence of benefits among distributors will have an effect on distributors incentives to take steps that would further modularization.

A first step is to look more precisely at the necessary type of action distributors must take to accomplish package improvements, in general, and modularization, specifically. Distributors have frequently acknowledged the futility of individual or a few firms acting to influence a manufacturer to make certain package improvements and the need for joint distributor efforts.[83] The difficulty of implementing

industry-wide packaging changes, such as modularization, for a small number of firms to achieve are even more difficult.[84] Most manufacturers must change in order to yield modularization savings for distributors. Consequently, concerted joint industry-wide efforts by many distributors are needed to implement a modular container system.

Whether individual distributors are willing to contribute to a joint effort aimed at modularization depends on the benefit they expect to receive. Such cooperative action, if successful, will result in products packaged in modular containers and their associated cost savings which will be available to <u>all</u> firms.[85] In cases such as this, where the benefits of cooperative efforts are shared, significant incentive problems often exist. For example, the NCOP found industry-wide innovations lacking in the food industry for the following reason:

> ...those [innovations] which require joint cooperative action may well reduce the general level of industry costs but offer no advantage to any single firm over any other...Standardized packaging and automated warehouses offer industry-wide savings but little advantage to the individual firm.[86]

An important reason identified for the existence of this phenomenon is the fragmented and heterogeneous nature of the food industry. The following statement by the NCOP attests to this:

> Fragmented industries generally find it difficult not only to initiate but also to finance the cost of developing innovations which benefit the productivity of every firm. (Such costs are often willingly shared in concentrated industries.) The problem is further complicated in the food distribution industry where vast differences exist in size and resources between the largest and smallest firms.[87]

The diversity of distributors complicates the problem because the issue arises of who should pay how much of the costs of joint action. For example, a distributor interviewed by the GAO stated that "big companies will have to realize that someone must take the first step."[88] Thus,

considerable disagreement may exist regarding how the costs of joint action should be distributed among firms. The costs of obtaining agreement on this issue are an additional barrier to modularization. The ability of an industry to agree on joint actions is a key determinant of the pace of such industry-wide innovation.[89]

A barrier that was alluded to in the above discussion was that of the lack of leadership. Because modular containers offer no advantage to one distributor relative to any others, it is argued that very little incentive exists for any firm to take the lead in working toward modular packaging.[90] The lack of leadership has lead Korchersperger to conclude that it is unrealistic to think that modularization will evolve through voluntary action of firms and that the issue needs to be addressed by some higher authority.[91]

7.1.6 Legal Barriers

Two types of legal barriers, fear of prosecution under the anti-trust laws and a general concern about government regulatory involvement, are addressed in this section.

A. Fear of Violation of Antitrust Laws

The first advocates of the "systems" approach to productivity improvement and the need for industry cooperation to implement system-wide innovations also identified the antitrust laws as a major constraint to such action.[92] In particular, anti-trust policy has been cited as a factor inhibiting food industry groups from setting package standards that would promote productivity advances.[93,94] G. Gentry, a supermarket chain executive, stated that "it is fear of attack by government that

has inhibited a strong effort attacking the proliferation of package sizes."[95]

After its inception in 1972, the NCOP began examining this problem and found that many productivity improvement opportunities which required coordinated efforts were not seized upon due to concerns about the antitrust implications of cooperative actions. The NCOP commented on one of these opportunities, standardized packaging, as follows:

> ...it [package standardization] would require joint industry discussions which we find retailers are reluctant to embark upon either because of a lack of understanding of the antitrust laws or a fear, sometimes exaggerated, of technical violation of these regulations. Manufacturers and growers are similarly inhibited.[96]

The NCOP suggested that antitrust regulations be clarified to reduce the uncertainty surrounding the legality of cooperative efforts to improve productivity. Apparently the situation was not much improved five years later since the commission in its final report identified the inability of firms to cooperate on research because of potential violation of antitrust laws as a barrier to technological innovation.[97]

Food industry managers' attitudes about the extent to which antitrust policy impeded joint efforts to standardize and modularize distribution packaging received further study in 1978. In the GAO's study of modularization, five of twenty distributor firms questioned expressed fears that modularization efforts would result in antitrust prosecution. One response indicated that previous trade-group committees had formed to discuss modularization, but broke up because of antitrust risks. Some manufacturers surveyed also pointed to antitrust complications as a barrier to modularization. However the GAO report concludes that such fears may be unwarranted. Review of statements by and consultation with

government antitrust officials revealed that few cases have ever been brought against private standards-making activity and that the legal test for violations of the law depend on the potential effect of the standards on competition. Meeting to discuss standard setting is not illegal since there is no competitive effect at this point. GAO discussions with Justice Department and Federal Trade Commission officials produced a list of guidelines on standards-making procedure to reduce antitrust problems. However, the Justice Department officials cautioned that there is no guarantee that antitrust prosecution will not occur in the future just because no intentions for action were expressed at the current time. Also, it was pointed out that government participation in standards-making does not grant antitrust immunity to the private parties involved. While the GAO revealed that food industry fears of meeting to discuss standards are likely to be unwarranted, there is no guarantee that further standardization activities will be immune from prosecution.[98]

Later in 1978 the NCPQWL commissioned a study of the perceived impact of government regulations on cooperative action to enhance productivity. Almost 73 percent of the 144 food industry executives surveyed held the perception that federal laws or regulations generally prohibited cooperative efforts. The report went further to conclude that:

> A substantial part of the reason why cooperative efforts have not been widely developed appears to be fear on the part of industry executives that these efforts would be interpreted, especially by the Federal Trade Commission, as being anticompetitive and in restraint of trade.[99]

In addition, the authors of the study concluded that considerable uncertainty surrounded the legality of cooperative behaviors. Executives were found to have differing views about various cooperative behaviors and many were unclear of the legality of such action. Fifty-nine percent of

respondents viewed package standardization as legal while 27 percent thought it was illegal and 15 percent had no idea of its legality. A slightly higher proportion (34.1 percent) of manufacturers perceived package standardization to be illegal than wholesalers (5 percent) and retailers (24 percent). Package standardization was one of the productivity opportunities that there was greater disagreement about legality among industry groups.[100] M. Pertschuck, then FTC chairman, was quite skeptical of the study commenting that "there is room for cooperation, just as long as it doesn't lead to an anticompetitive situation."[101]

B. Fear of Government Action

A fear of direct government involvement in the regulation of package sizes has been expressed. For instance, Haberman in citing the need for an industry concensus to move modularization forward, warns that:

> There is another way - government or another type of edict. I cannot and do not believe that we can afford to enforce standardization of any kind absolutely. Our system of marketing is just too complex. Once imbedded in law, once force is applied to the dimensions of the solution, it is most difficult to undo. An idea that limits our marketing flexibility must be tested continuously under varying circumstances in the free market. If government does it, it takes an act of Congress to undo it. If businessmen do it, there is a real possibility that the balance will be kept, that whatever the design there will be room for refinement, direction will be more important than form, and allowance will be made for continuous testing and fine tuning to the future and unknown.[102]

The above quote nicely illustrates the business persons' objections to government involvement in package standardization. Some have expressed the belief that modularization will only occur if government becomes more directly involved.[103,104] If this is widely believed in the food industry, then the biases against government involvement in standardization could be acting as a further obstacle to modular package adoption.

7.2 Interview Results

The results of personal interviews with food industry firms' and trade associations' personnel are presented in this section. First, the general categories of factors most frequently identified as major barriers to modular packaging by manufacturers and distributors are presented. Second, more specific institutional barriers identified by individuals interviewed are described.

7.2.1 Factors Perceived To Be Important Barriers To Modular Packaging Adoption

Through the interview process, a large number of diverse factors were identified as major obstacles to the adoption of modular packaging. As the interviews progressed, certain categories of factors were mentioned repeatedly. The categories identified most frequently by manufacturers and distributors are listed and described below. The barriers that were commonly identified by both groups are identified. Also, several factors hypothesized at the study's outset as possibly important variables which were not identified by respondents are noted.

A. Manufacturers

The following seven general classes of factors were frequently identified as important impediments to modularization. While no precise statistical analysis was attempted, the order of presentation does indicate, in a general way, how often each category was identified. The first three were identified by the majority of individuals interviewed while the latter four were identified by only several respondents who stressed the importance of these variables.

- Potential Negative Impact on Manufacturers' Marketing Flexibility
- Relatively Less Importance Assigned to Distribution Productivity Than Marketing Goals
- Lack of Documentation of Effects
- Uneven Benefit and Cost Incidence
- Inherent Diversity of Food Products Prevents Significant Standardization of Container Sizes
- Potential Constraint on Technological Innovation in Food Packaging
- Distributor Diversity and Lack of Agreement on Desired Package Improvements

1. Potential Negative Impact on Manufacturers' Marketing Flexibility. Modularization of shipping containers was interpreted by manufacturers interviewed as being tantamount to standardization of retail package sizes. Consequently, manufacturers perceived that modularization will limit their freedom to shape retail packages and thus reduce their flexibility to use packaging as a marketing tool.

In the interviews, the retail package was described as the centerpiece of manufacturers' marketing and competitive strategy. Respondents stressed the role of retail package size and shape in determining a product's uniqueness, attractiveness, and exposure to consumers. Package dimensions help project the product's quality image which distinguishes it from other products. They also affect consumers' perception of the price-value relationship of the product. Interviewees also emphasized that retail package size affects a product's attractiveness and exposure to consumers on supermarket shelves and thus intimately affects sales. One analogy made was that packages serve as "billboards" which stand out on a shelf and catch the eye of passing shoppers, especially impulse

buyers. Thus, manufacturers manipulate package size to gain more shelf exposure and a larger market share.

Since modularization was viewed as necessarily limiting retail package sizes, the effect on manufacturers' ability to use package size to market products was viewed as a major problem with modular packaging. Comments suggested that resistance was founded on expected negative sales impacts from: 1) altering the retail package in a way; and 2) standardizing sizes. Several individuals interviewed suggested that manufacturers were reluctant to change retail packaging because of a fear of affecting consumers' perceptions of the product and its value. A comment made was that "marketing is more of an art than a science" and that when you have come up with a successful package, such as the Heinz ketchup bottle, you "don't fiddle with it." Several "horror stories" were conveyed to the author about manufacturers who had made minor changes in their retail packages that were followed by significant sales declines. Distribution personnel indicated that attempts to achieve internal efficiencies had often encountered this "hands off" policy toward retail package changes. Several individuals did report that there was some success in getting distribution concerns incorporated into new product packages and in changing the case pack to improve transportation space use.

Several probable impacts of standardizing retail package sizes on marketing and competitive strategies were identified. First and foremost was that retail package size standards would force products to be similar and thus compromise their individual uniqueness and competitive advantage over one another. Second, one manufacturer suggested that uniform retail packages would change product quantities in packages and

cause some products to be forced into price ranges where they are not competitive. Moreover, modularization was perceived as a severe limiting on marketing flexibility that would meet strong opposition from marketing departments and, because of these departments' fundamental role, from the manufacturing sector as a whole.

2. Relatively Less Importance Assigned to Distribution Productivity Than Marketing Goals. The embedded pursuit of marketing objectives in manufacturer decision processes was identified as an important barrier to modular package implementation. Several manufacturers communicated the essence of this barrier by stating that "the dog wags the tail, not the other way around." This simple analogy was used to describe what drives the food system, its impact on organizational relationships, and specific decision practices.

One manufacturer gave the following description of how the food system operated. The consumer is the focal point and key actor. Marketing activities, particularly media advertising, aimed at consumers were identified as the "engine" which drove the rest of the system. These activities tend to differentiate products, add value to the product, and increase total revenue. Other respondents concurred that marketing was the driving force in food manufacturing companies and that physical distribution received lower priority within the firm. Referring back to the canine analogy, marketing is the "dog" and distribution the "tail." Several examples of the decision processes which reflected this organizational relationship were given. For instance, the product manager of the marketing department makes decisions on retail package sizes. Shipping containers are then built around the chosen retail sizes.

Several respondents described the distribution as being a passive function which "took whatever marketing gave them." However, a few others noted that this traditional role was changing and that distribution was beginning to have greater say in package design decisions. Rising fuel and interest costs, transportation deregulation, and increasing sophistication of distribution managers were mentioned as factors in this trend.

The pursuit of marketing over distribution productivity goals is a barrier to modularization since opportunities, even those internal to the manufacturer, to lower distribution costs through package design changes are often overlooked. In sum, the basic idea of designing packaging for efficient distribution runs counter to the current practices and thus can be viewed as the "tail attempting to wag the dog."

3. Lack of Documentation of Effects. An important barrier to modularization cited by manufacturers was the lack of hard quantitative data on the effects of implementing modular packaging. A trade association representative interviewed stated that while textbooks and industry discussions had suggested that benefits of modularization existed, savings for the U.S. food industry were as of yet hypothetical and unproven since they have not been quantified.

Comments by respondents pointed to uncertainty about the type and magnitude of benefits to distributors and costs of manufacturers. Several manufacturers felt that the benefits to distributors were not that obvious and that they needed to be further studied and quantified into hard dollars and cents figures before serious consideration could be given to modularization. Other respondents indicated that while there

has been some study and significant discussion of the benefits of modularization, little or no effort had been given to considering and documenting implementation costs. A trade association representative indicated that these costs included not only the physical conversion costs but impacts on marketing flexibility. The ability to quantify these marketing effects was questioned by this trade official and one manufacturer representative interviewed.

4. Uneven Benefit and Cost Incidence. The belief that the benefits of modularization would primarily accrue to distributors and costs would be borne by manufacturers was cited by several manufacturers and the trade official interviewed. Modularization was perceived to produce net costs for manufacturers since potential savings were either viewed as being nonexistent or insignificant or that benefits to manufacturers were more than offset by conversion costs and marketing impacts.

The disparate benefit and cost distribution led one manufacturer to frame modularization as a zero sum or "win-lose" situation in which the key question was: "Whose (manufacturers' or distributors') ox gets gored?" Several other respondents concurred that there was little reason for interest in modularization on their part since it offered few, if any, benefits to them.

A note should be made regarding the above points. The uneven benefit and cost incidence was mentioned as a barrier by representatives of larger firms in the sample. Distribution managers of smaller firms tend to identify greater savings potential from modularization and did not raise the issue of uneven distribution of effects. A possible explanation is that managers in larger firms had a broader view of impacts on manufacturing firms, including those on marketing.

5. Inherent Diversity of Food Products Prevents Significant Standardization of Case Sizes. The issue was raised by individuals who questioned whether standardization of case sizes was, in fact, possible. As noted, most viewed that modularization would necessarily involve limiting retail package sizes. Such standardization across all grocery products was perceived as difficult, if not impossible, because of the inherent diversity of food products.

A number of attributes which differed across products and made standardization difficult were mentioned. First, the density of products is a major point of difference both within and between product categories. Different ingredients affect the volume a product occupies to arrive at a particular net weight (which is often the same for products in a particular category). Packages are designed to fit the product as precisely as possible to minimize unused interior space which can add to storage and transportation costs and result in damage and losses. Development of new product formulations with different consistencies, such as flaked coffee, creates the need for new package sizes. The portions desired by various consumer segments was emphasized as a second reason for package size diversity. In addition, package dimensions are chosen for convenience in handling by the consumer group which uses them. Finally, the size or shape of the raw commodity in some cases, such as the height of asparagus spears, influences the physical dimensions of the retail package.

One larger manufacturer representative illustrated the difficulty posed in standardizing diverse products by describing the new product introduction process. It was pointed out that in the development of a new product, the manufacturer and the product manager have a vested

interest in standardization to keep the capital needed for producing the item down. For instance, if the new product could be manufactured on existing equipment, costs would be lower. Thus, considerable internal inertia exists to standardize products. However, this executive stressed that these savings cannot be taken advantage of because of the individual characteristics of the product (e.g., density, constituency, portion) dictate the size of the retail package and consequently the shipping container. In this person's view, the key question is: "Can the existing diverse products be standardized to a degree to yield significant distribution cost savings?"

6. Potential Constraint on Technological Innovation in Food Packaging. Several respondents indicated that the potential constraint of package standards on technological innovation could be a major cost and reason for resistance to adoption of standards. The process of package change was described by one manufacturer as an evolutionary process. It was suggested that standards imposed at any point along the way would "freeze" this process and probably result in higher costs. A few other manufacturers expressed similar concerns that package standardization would inhibit future technological changes which were as of yet unforeseen. Aseptic packaging was cited as a fundamental innovation in packaging that one could have foreseen ten years ago but could have been impeded had standards been implemented.

7. Distributor Diversity and the Lack of Agreement on Desired Package Changes. This factor was identified by two manufacturing representatives and a trade association official interviewed. The basic idea conveyed was that there was no such thing as a "monolithic" distributor

trade that had a single preference for shipping methods or packaging. Rather the distribution business was viewed as being made up of very diverse entities in terms of size, facilities, and methods.

8. Legal Factors. Distribution managers were asked if legal factors, such as antitrust policy, were an impediment to modular package adoption. The responses were mixed. Some thought that antitrust was not an issue while others believed it could be a concern. Those holding the latter view emphasized that antitrust problems would result if firms acted to collectively act to implement standards.

Trade association officials interviewed indicated that antitrust concerns were always a factor in the adoption of system-wide innovations. A particular problem cited was that of distributors attempting to collectively enforce standards. For example, if a number of firms decided to not accept a product unless it met specified standards, charges of collusion and restraint of trade could be levied in legal action against these firms. However, a distinction was made by one official between discussion and implementation of industry-wide changes. Antitrust law was not a barrier, in this person's view, to the discussion of shipping container standardization or for that matter any topic as long as the proper legal framework (e.g., open, pluralistic, and formalized) was established. Even within such a framework, there was no guarantee that antitrust prosecution would not occur. However, as the process moves from one of discussion to one of implementation, the antitrust problems multiply. Under the current legal structure, the only role trade associations can play is in creating a set of recommendations which are voluntary. There is no way that an association can prevent an individual firm from refusing

to go along. A final point made was that the private lawsuit from a firm perceived to be harmed by a standard is more of a concern in this process than public antitrust prosecution.

Two additional concerns relating to government were brought out during the interviews. First, several firm managers believed that the only way modularization could be implemented was by government fiat and expressed a strong dislike for this option. Secondly, government interest in metrication, which was perceived to be much stronger in 1974 (when the A.D. Little study was performed), was seen as a way to reduce or minimize costs of implementing modularization. After passage of the Metric Conversion Act of 1975 (P.L. 94-168) which called for voluntary conversion and no specific timetable, it became apparent that metrication would not be an immediate opportunity to lower costs of modularization. This Act created a U.S. Metric Board which was funded in 1978 but phased out by Reagan Administration budget cutting in 1982.

B. Distributor Results: Distribution Managers

Distribution managers and executives in thirty-three wholesale or retail chain firms were interviewed. The eight factors most frequently identified as barriers to modular package adoption are presented below and a short summary of each follows. Table 7.1 more completely illustrates the interview results by indicating the frequency of all factors perceived by respondents to be obstacles to modularization.

- Relatively less importance assigned to distribution productivity than retail merchandising goals.
- Potential negative impact of manufacturers' marketing flexibility.
- The inability of one firm to affect change.

Table 7.1 Modularization Barriers Identified by Distribution Managers in Wholesale and Retail Chain Firms

Barrier	Number of Firms Identifying*
Relatively less importance assigned to distribution productivity than retail merchandising goals.	22
Potential negative impact on manufacturers' marketing flexibility.	22
The inability of one firm to affect change.	21
Lack of quantitative estimates of the effects of modularization.	18
The uneven incidence of benefits and costs among industries.	16
Lack of distributor awareness of modularization benefits.	11
Short term focus of industry.	11
Distributor diversity and lack of agreement on desired package design changes.	10
Magnitude of the effort to implement modular packaging.	8
Entrepreneurial nature of food industry firms.	8
Concerns over legal actions.	8
Lack of interest and leadership	7
Low profitability of the distribution sector.	7
Traditional nature of the food distribution industry.	5
Concern over government regulation of package size.	5
Savings from modularization are of insufficient magnitude.	2
Potential negative impact on small firms and competition in food manufacturing.	2

*Thirty-seven firms were interviewed. The total exceeds 37 because most firms identified more than one barrier.

- Lack of quantitative estimates of the effects of modularization.
- The uneven incidence of benefits and costs among industries.
- Lack of distributor awareness of modularization benefits.
- The fast pace of industry activity causes firms to focus on short term problems rather than addressing package standardization which will take time to implement and thus produce longer term payoffs.
- Distributor diversity and lack of agreement on desired package design changes.

1. Relatively Less Importance Assigned to Distribution Productivity Than Retail Merchandising Goals. This barrier was elaborated upon in the interviews in several ways. Distribution managers were quick to point out that the primary thrust of their firm was toward the sales end of the business rather than distribution operations. For instance, several wholesalers said their firm made its money by "buying at the right price and selling at the right price," not in the firms physical distribution operations. A trade association representative noted that wholesalers are increasingly making their money from being better dollar managers and through application of electronic information technology to assist the retailer with product movement at the store level, rather than from increased distribution efficiency. Respondents from retail chain companies emphasized that the heart of their business was the retail store with the focal point being sales from the supermarket shelf. Buying, merchandising and store operations were thus seen as functions having greater visibility and importance than distribution activities in their companies. One respondent indicated that merchandising/procurement departments have been overwhelming forces within their firms.

The philosophy within distributor organizations toward the distribution function was discussed by interviewees. Respondents indicated

that distribution was not considered a profit center but rather its basic purpose was to "serve the retail stores." A trade association leader concurred, stating: "operations, such as distribution, are a servant of a sales organization." Several interviewees stated that the philosophy which existed in some retail chain firms was that distribution operations were a "necessary evil."

Implications of the organizational relationships described above for distribution productivity improvements through improved packaging are drawn below. First, respondents emphasized that the relationship and communication channels between procurement and distribution departments were not well developed. A few commented that, in some cases, animosity existed between the departments and that individuals in the two parts of organization because of differing philosophies "did not see eye to eye." However, several other respondents indicated that this intrafirm relationship was improving (see Chapter 8). Second, buyers and merchandisers, due to the nature of their education and training, were not well-oriented to distribution concerns. Consequently, it was thought that it was hard for them to understand the correlation between case size and distribution costs. Third, one respondent argued that the lower level of sophistication of staff and executives in distribution vis a vis store operations was an impediment to modularization.

2. Potential Negative Impact on Manufacturers' Marketing Flexibility. Interviewees perceived that modularization would be resisted by manufacturers because standardization ran counter to their marketing strategies and would limit their flexibility. Two aspects of standardization were mentioned: 1) altering the case pack; and 2) standardizing

the retail package. Several respondents expected that there would be reluctance on the manufacturers' part to change case count, especially downward, since it affects how much product is shipped to the store and thus often determines the amount displayed on the shelf and the consumer exposure received.

Standardization of the retail package flies more directly in the face of manufacturers marketing philosophy. Respondents stressed that retail packages are designed with the purpose of attracting consumers to purchase the product and shipping containers merely designed around them. Limiting variation in package size would meet resistance for three reasons. First, it would infringe upon the sensitive area of competition through package design for greater supermarket shelf-space and consumer exposure. Second, it would affect the quantity of product contained in a package and thus its price. Third, standardizing packaging could necessitate changes in the product, such as portions, which may reduce consumer purchases. Finally, limiting retail package sizes may diminish the uniqueness or individuality of a product possibly affecting consumer perceptions of the product's value and triggering adverse consumer reactions. One respondent suggested that an important barrier is that the marketing people in manufacturer firms are unwilling to have their creativity--their attempts to figure out the consumer--limited since that is where they get their "kicks" or enjoyment. This person went further to acknowledge the importance of creativity for morale and gave the example of distributors "getting their kicks" from devising new store formats which attract consumers.

3. Inability of One Firm to Affect Change. Distribution managers expressed the opinion that their firm acting alone was unable to affect the implementation of packaging improvements, including modularization. They concluded that some form of collective action through industry organizations was required for improvements to be implemented.

Respondents offered several support reasons for their lack of power to individually affect change. First and foremost was their weak position vis a vis the major national manufacturers. In the words of one interviewee, suppliers with an established brand franchise and heavy media advertisers have a distributor "over a barrel" since it cannot refuse the supplier's products for fear of losing sales to competing distributors carrying the item. A trade leader interviewed concurred with this view. However, one large regional distributor indicated that it had discontinued a major manufacturer's product line. Second, several retail and wholesaler representatives believed that their firms were too small to accomplish much change and that leading national firms would need to collectively act through industry organizations. Third, representatives of retail chains emphasized the extremely high cost to an individual company in working with many vendors to accomplish change and the risk associated with such efforts because of the low probability of success.

4. Lack of Quantitative Estimates of the Effect of Modularization. Respondents identified the lack of hard estimates of modularization impacts for industry sectors as an impediment to modularization. A need was expressed to identify and quantify the effects of modularization for manufacturers and distributors in order to determine if net savings for

the system were positive. This information was pointed out as necessary because manufacturers would not want to see the price of their products increase. Similarly, distributors would be unwilling to pay more for modular packages to cover changeover costs unless the savings which accrued more than offset these increased costs. Several respondents believed that information on the benefits was needed to increase awareness among distribution managers and to educate merchandising and procurement people in distributor firms. Two trade leaders interviewed agreed that the lack of documentation of costs and benefits has inhibited progress. However, several respondents emphasized the difficulty of coming up with hard dollar figures for modularization savings areas, such as damage reduction, due to the many factors at work and because costs (i.e. damage) was frequently "hidden" and spread through the distribution system.

5. Uneven Incidence of Benefits and Costs. While interviewees identified substantial benefits in their distribution operations, they emphasized that manufacturers would have to bear the cost of retooling their physical equipment to obtain these savings. One retailer leader phrased it this way: "What's in it [modularization] for the manufacturer?" Several distribution managers and two trade leaders interviewed suggested that manufacturers, since they also operate distribution centers, would benefit from modularization. However, the majority of interviewees perceived a disparate incidence of benefits and costs.

6. Lack of Distributor Awareness of Modularization Benefits. The lack of awareness of the potential savings in the distribution industry was identified as a factor inhibiting modularization. Awareness of modular packaging and its benefits on the part of buyers and merchandisers

was most often cited as a problem. A wholesaler representative emphasized a lack of awareness and understanding of modularization savings by top management. Two respondents indicated that distribution managers themselves share part of the blame. One estimated that managers in one-half of the top 100 distributor firms have a lack of awareness, or more precisely, a lack of appreciation for what modularization would mean in distribution savings. This executive stated that "it takes pretty hard thinkers to figure out that modularization may eventually reduce warehouse cube by say, 10 percent. Not everybody thinks this far." Two trade association leaders interviewed disagreed with this point. Both felt that a general awareness of modularization and its benefits existed among distribution managers in the industry. One leader distinguished between awareness and concern. He stated that some firms even though they are dedicated to productivity just adapt to the sizes which exist.

7. Short Term Focus of Industry. Respondents identified the general orientation of the food distribution industry to short run problems as a barrier to modularization. Firms were described as focusing on day to day operations and "putting out brush fires" instead of addressing larger problems which promised longer term benefits. The primary reason cited for this orientation was the fast-paced nature of industry activity. The short run orientation was also expressed in terms of the return on investment (ROI) criterion. Several interviewees stated that modularization was not a high priority for their firm because returns from other efforts offered more of a "bang for the buck." A trade organization representative indicated that alternatives in electronic technology provide greater payback to firms' investments than modularization. Another

trade leader argued the three, four or five year horizon of firms is a major impediment to implementation of innovations such as modularization with longer run payoffs.

8. Distributor Diversity and Lack of Agreement on Desired Package Design Changes. The fragmented and diverse nature of the food distribution industry were cited as factors inhibiting progress toward modularization. Different distributors were argued to have different needs because of the types of retail outlets served (e.g., convenience vs. warehouse store). In addition, a representative of a leading retailer commented about the extent of variation in warehousing methods saying "no two grocery warehouses in the U.S. are operated in the same way." Interviewees raising this factor as a barrier felt that the diversity of their firms led to different demands for package improvements. This lack of a concensus, or in other terms, the lack of an ability for distributors to "speak with a unified voice" was perceived as an impediment to package improvements in general.

9. Magnitude of the Effort to Implement Modularization. Interviewees viewed modularization as an ideal or ultimate solution to the problem of case size proliferation which promised tremendous savings. A basic problem identified was that achieved modularization would require an effort of enormous magnitude. One interviewee put it this way: "The benefits are obvious, but the task of achieving it is so big that it scares people." After acknowledging the benefits, another executive interviewed commented on the tremendous implementation job by saying " our firm can't afford to send someone out in search of the Holy Grail." Instead, this person as well as several others suggested that gradual

steps be taken toward implementation. Thus the idealized concepts could be split into more manageable proportions.

10. Entrepreneurial Nature of Food Industry Firms. Some distribution managers felt that the entrepreneurial (independent and self-interested) nature of firms was an obstacle to modularization. For example, after the modular concept was explained to one interviewee, he immediately stated that implementation would not happen because it was uncharacteristic for one participant to do anything to benefit anyone else in the system. Several others specifically pinpointed a lack of trust between supplier and distributor as a barrier to modularization. Two respondents indicated that extremely entrepreneurial behavior of manufacturers was an important factor inhibiting cooperation to implement standards. An example of entrepreneurial distributor behavior given was that of "greedy" firms who did not use certified pallets and contributed to failure of an industry-wide pallet exchange program in the mid-1970s.

11. Concern About Legal Actions. Interviewee comments generally indicated that antitrust problems would very likely be encountered if individual firms attempted to get together to either discuss or attempt to demand modular sizes. Most indicated that this was the reason why modularization efforts needed to be funneled through industry organizations. While the majority of those identifying this barrier did not elaborate on the nature of the antitrust problems, one chain representative mentioned the sensitivity of its firm to the threat of private treble damage suits.

Six respondents held strong views that antitrust was not a significant barrier to modularization. For example, one executive said

"antitrust is a good excuse for doing nothing" while another stated that antitrust was "something that manufacturers were hiding behind as they did in the backhaul issue." The remaining comments were more moderate indicating antitrust was a concern but not a constraint.

Several trade officials interviewed commented on antitrust. Representatives of two associations did not believe that antitrust law was a barrier to modular container adoption primarily because it was an efficiency issue. One further argued that since there were no problems relating to exclusion of an industry segment, terms of sale or pricing involved in modularization, that government antitrust policy was not an obstacle. A third trade leader pointed out that it was not illegal for an industry group to talk about standards. It was definitely illegal for such a group to collectively attempt to enforce standards by refusing to buy a suppliers product that did not meet the standards. Private suits from individual parties harmed by a standard were viewed by one official as being more of a difficulty than government prosecution. Another noted that voluntary guidelines had been used to alleviate legal difficulties in implementing industry-wide standards.

12. Lack of Interest and Leadership. The lack of leadership on the part of several participant groups in the industry was cited as a factor impeding modularization. First, the lack of interest and support from distribution people, and the failure to organize the interest that existed was perceived as a problem. Second, the lack of interest and commitment from top managers was identified as a problem. Third, the fact that major firms, either suppliers or distributors, have failed to take a leadership position on this issue was pinpointed as a barrier by

several respondents. A trade leader phrased the leadership problem as: "we (distributors) are a lot like sheep," once there is some movement in one direction many firms begin to follow and a movement gains momentum.

13. Low Profitability of Distribution Sector. Low profit margins were identified as a barrier for two reasons. Respondents stated that distributors would be reluctant to pay more for products in modular containers to offset manufacturers' conversion cost since it would further squeeze their margins. Another respondent indicated that the low returns in a fairly risky business made firms less likely to be willing to pay for modularization. One interviewee brought up the relatively higher profitability of manufacturers. Similary, a trade official brought up the industry mentality as a barrier to such an exchange. This individual stated that asking the distributor to pay for modularization is similar to "having the parishioners passing the basket to the priest."

14. Traditional Nature of the Food Distribution Industry. Several respondents cited the inertia of industry practices as a factor inhibiting modular packaging, or for that matter, any change. One interviewee phrased it this way: "We just don't have revolutions in the grocery business."

15. Concern Over Government Regulation of Package Size. Two respondents expressed a fear that if the distributors succeeded in generating too much interest that it might result in government action and extra rules and associated costs to food manufacturers. Other similar views were that the only way modularization could occur was by

government fiat, to which they were vehemently opposed. A trade leader interviewed concurred stating that if the only way to implement package standards was through legislation, he believed it was not worthwhile "since the loss of freedom was more precious than those few dollars saved."

16. Savings from Modularization Are of Insufficient Magnitude. Two distribution managers indicated that the reason that the distributor sector had not pursued modularization was that the benefits were not substantial. One comment indicated that the payoff was insufficient relative to other opportunities. The other respondent felt that the incremental benefits of modularizing after certain basic improvements (e.g., improving packaging quality and precise fitting of unit loads on pallets) were made may not be substantial.

17. Potential Negative Impact on Small Firms and Competition in Food Manufacturing. One respondent identified the cost to some manufacturing firms as a barrier to implementation. The other interviewee citing this factor felt that standardization could negatively impact small firms by eliminating opportunities for them to specialize in unique markets with unusual sizes and forcing them to compete directly with the big suppliers.

18. Labor Unions. A barrier to modular package adoption hypothesized at the research project's outset was resistance by organized labor. In the early interviews, respondents were asked to comment on whether labor was neither a current obstacle nor would be an obstacle to future standardization. Several comments pointed to a lack of awareness and

understanding on labor's part of how standardization could impact productivity, automation and total labor requirements.

C. Distributors: Buyers/Merchandisers

Buyers/merchandisers in eleven firms were interviewed as part of this research. Factors which were identified during these interviews are presented in Table 7.2 and described below.

1. Potential Negative Impact on Manufacturers Marketing Flexibility. Respondents stressed manufacturers' interest in maintaining the flexibility to vary package size to make an individualized unique product. A respondent stated "we don't want to take away from manufacturers' creativity." One respondent emphasized that products were sized to facilitate consumer acceptance of their price and that concerns about modularization were related to negative consumer reactions to prices of altered retail sizes. Several others felt that case size standardization which either changed cash pack or retail sizes would affect manufacturers ability to compete for visibility on supermarket shelves.

2. Inability of One Firm to Affect Change. Interviewees noted that their firm could do little to implement modularization because as one company they could not refuse a brand manufacturer's product that sells. A buyer particularly emphasized this saying: "The retailer is a pawn of the manufacturer. I am forced to carry products which are hot items produced by the great marketing companies." One respondent noted that it was possible to work out smaller problems, but for larger efforts, such as package standardization, a firm cannot do much alone. Several interviewees noted that even small improvements can be difficult

Table 7.2 Modularization Barriers Identified by Buyers/Merchandisers

Barrier	Number of Firms Identifying*
Potential negative impact on manufacturers' marketing flexibility.	7
Inability of one firm to affect change.	7
Distributor diversity and lack of agreement on desired package design changes.	6
Lack of quantitative estimates of the effects of the modularization.	6
Lack of awareness of modularization and its benefits.	5
Inherent diversity of grocery products.	3
Short run focus of the industry.	3
Conversion costs for manufacturers.	3
Relatively less importance assigned to distribution productivity than retail merchandising goals.	2
Potential labor resistance.	1

*Eleven buyers were interviewed. The total exceeds 11 because several buyers identified more than one barrier.

for a single firm to achieve. Two buyers indicated that a manufacturer might say that it would be prohibitively costly for it to change just for one firm. Another indicated that when similar problems were identified by a number of firms and brought to a supplier, an improvement was more likely.

3. Distributor Diversity and Lack of Agreement on Desired Package Design Changes. Buyers/merchandisers mentioned the individualized needs of different distributors and thus the problem of diverse and possibly conflicting demands being conveyed to manufacturers. Several cited the need for increased communication, identification of problems and presentation of a unified front to suppliers.

4. Lack of Quantitative Estimates of Effects. Interviewees cited the absence of hard figures on savings as a factor inhibiting efforts toward modularization. One buyer said that "no one had demonstrated the need for it yet." Another indicated that if top management were convinced of the savings, pressure could be brought on buyers to purchase products in modular sizes.

5. Lack of Awareness of Modularization and its Benefits. Several respondents interviewed believed that there was ignorance among buyers of package standardization and modularization of their effects.

6. Inherent Diversity of Grocery Products. The varied nature of products and retail package sizes and different item turnover rate was argued to make substantial case standardization impossible. Rather the only standardization believed possible was that within product categories, not across them.

7. Short Run Focus of Industry. Several buyers identified the short-run orientation of decision making as a barrier. One respondent believed that a preoccupation of some managers with day to day operations led to "tunnel vision" which prevented them from seeing broader, longer run opportunities available through standards. The fast pace of the food business was argued to force decision making "by the seat of the pants" rather than consideration of longer term implications.

8. Conversion Costs to Manufacturers. The costs of retooling or replacing packaging equipment was cited as a prohibitive factor to modular package implementation.

9. Relatively Less Importance Assigned to Distribution Productivity than Retail Merchandising Goals. Two interviewees identified the relatively less emphasis on productivity vis a vis merchandising as a barrier to modularization. A respondent indicated that unless top management is interested, most buyers are not really concerned with distribution costs. Another buyer indicated that distribution inefficiencies associated with shipping packages were not of great concern since they "were selling the product not the package [case] and the consumer isn't directly affected."

10. Potential Labor Resistance. A buyer working for a firm with a mechanized/automated facility foresaw the possibility of labor resistance if modularization led to elimination of entire job definitions (e.g., order selecting). This respondent noted that past mechanization had involved changing job responsibilities but basically keeping job definitions. He predicted that eliminating complete functions would

threaten job security and meet resistance in this heavily unionized industry.

D. Broadly Identified Barriers

Five factors were identified by distribution managers in both manufacturing and distributing firms as obstacles to modular package implementation. These broadly or commonly identified barriers are listed below.

- Potential negative impact on manufacturers' marketing flexibility.
- Relatively less importance assigned to distribution productivity than marketing/merchandising goals.
- Lack of quantitative estimates of effects of modularization.
- Uneven benefit and cost incidence.
- Distributor diversity and lack of agreement on desired package design changes.

7.2.2 Institutional Barriers to Modular Package Adoption

Institutional barriers to modularization, as noted, are the features of the existing institutional structure which do not provide the necessary incentives to or constraints upon participants to adopt modular packaging. While some of these barriers were covered in part in Section 7.2.1, the emphasis here is upon the identification of specific instances where institutional arrangements appear to be incapable of guiding behavior to yield performance desired of the food system. Interviewees provided a wealth of information and insight as to what these problems were. The results are presented according to the way they were investigated. First, six broad areas of institutional problems emerged from asking interviewees the following question: "Given the potential savings of modularization, what prevents it from being adopted?" Second, the results of questions

about specific behavioral practices hypothesized to be impeding modular packaging adoption are presented. Documentation of these practices was needed to verify observations of the literature review.

A. Problems Identified by Interviewees

The institutional problems observed by firm managers and trade officials were: 1) horizontal systems barriers (competition); 2) vertical systems barriers (external effects); 3) lack of distributor competition; 4) distributor behavior in private label products; 5) threshold for benefits to be realized; and 6) sharing of benefits.

1. Horizontal "Systems" Barriers: Problems of Coordination Among Competing Firms. The problems discussed here have one thing in common--individual firms acting in their self-interest produce an overall result which is suboptimal from a standpoint of all firms at that industry level. More specifically, the competition engendered by the market system prevents the coordination required to implement standard package sizes. Thus, the market itself, as currently instituted, is a barrier to modularization.

Several manufacturers provided insights into how the competitive system was a barrier to implementing standards. Table 7.3 illustrates manufacturer views expressed during the interviews. The thrust of the comments is that the self-interested, perhaps opportunistic, behavior of suppliers seeking to improve their market share prevents any one firm from taking a step toward reducing the number of package sizes. Quote 2 casts manufacturer package size decision making as a runaway or escalating problem. While they all might be better off through greater internal efficiencies, no single firm can stop the package proliferation

Table 7.3 Illustrative Comments of Manufacturers About Competition As a Barrier to Modularization

1.	"What manufacturer is going to voluntarily eliminate a size and observe how many customers they lose? Nobody wants to be the first guy to do it because the costs of being wrong are so high. Only if everybody agrees to discontinue a particular size, will our firm discontinue that size."
2.	"If we decide not to have a certain size, firm X (our competitor) would produce it to increase market share. Nobody wants to drop an old one (size) for fear of competition picking it up. Everyone is always willing to add an additional size to attract more consumers and market share. The result is a situation where no one can stop proliferating sizes."
3.	"The direct competition between food manufacturers is a barrier to modularization. Firm X and Y (competitors) would do something to hurt us with little concern for modular packaging. The basic question is: Whose ox gets gored? The fewer case sizes we [the industry] have the better, as long as those sizes are the <u>right</u> size for Z [my firm]."
4.	"In an attempt to satisfy consumer complaints about retail packages, we once redesigned packages; making them smaller. We almost blew that part of our business since our competitors didn't follow suit and kept their bigger boxes that were more visible on the shelf."

process. The person who made comment 3 views standardization as a "zero sum" game in which firms whose sizes are chosen as standard sizes would win and other firms would lose. Opportunism of competing firms is implied. Quote 4 describes the experience of a manufacturer which was frequently cited by interviewees as a reason not to "fiddle with" retail packaging because of adverse marketing and sales consequences. In sum, the comments point to the futility of individual action and that standardization is possibly only through collective agreement.

Distributors also pointed to the competitive system an impediment to standardization. Table 7.4 presents comments made by distributors. Quote 2 provides a vivid description of the incentives facing an individual supplier to improve packaging. This person saw simultaneous implementation as the only feasible way to standardize. Quote 3 provides an example of the problem of one manufacturer acting alone to change packaging. Comment 4 illustrates the competitive problem from the retailers' standpoint. Quotes 5 and 6 identify the problems an individual supplier would encounter in trying to recoup conversion costs.

2. Vertical System Barriers: Effects of Decisions not Taken into Account. Distributors interviewed expressed a strong opinion that manufacturers did not consider impacts at the wholesale and retail chain warehouse in their decisions. Thus, a barrier to package changes which would lower distributors' costs is the inability of the market to convey distributor preferences for package improvements and for manufacturers to take these preferences into account.

Table 7.5 presents some representative comments of distributors and manufacturers. The person making remark A-1 frames the general problem

Table 7.4 Illustrative Comments of Distributors About Competition As a Barrier to Modularization

1. "The free enterprise system keeps modularization from happening. Competition between manufacturers for shelf space results in all the different sizes. These things won't happen unless somebody makes them happen."

2. "The problem is that there is no economic incentive to a manufacturer. If the cost of retooling equipment, say 5 or 10 cents per case, is added to its product's cost, then this becomes a competitive disadvantage for the manufacturer who does make the change. From a supplier's standpoint, why should it spend a half-million dollars to change when it can't get anything back. A retailer won't be willing to pay more for savings in the warehouse....The incentives for voluntary adoption by manufacturers don't exist--if you raise your product's cost, you cut your own throat. Why is dog food still in a bag? Because the first guy who puts it in a case increases his unit costs and becomes uncompetitive. The only way is if all suppliers change and raise their prices in lockstep."

3. "Kimberly-Clark once marketed a compressed facial tissue in a smaller package which benefitted distributors by allowing more cases to be put on a truck. They ran into a problem since their competitors didn't follow them. Consumers perceived the product to be of lesser value and the firm was disadvantaged versus its competition. So a manufacturer could help us, but it could be detrimental to the manufacturer....We can't get all the manufacturers to work together."

4. "Nobody [distributor] will be the first to do it [pay more for modular package to cover retooling costs] because they will be put at a competitive disadvantage."

5. "The manufacturer doesn't have the incentive to modularize. Nobody (buyers) wants to pay extra for the box. There is no effect at store level....Before manufacturers will change the retailer must agree on the price they will pay for the change."

6. "I don't see it [modularization] happening. The competition at both levels is a problem. Will a sufficient number of retailers want modular packages? If they cost more, retailers won't buy them."

Table 7.5 Illustrative Comments About Manufacturers Package Design Decisions

A. Distributors

A-1 "The supplier doesn't see the problem [of case size proliferation] in the shipping of their unit loads."

A-2 "To the extent that distribution people in manufacturing firms have gotten involved [in package design decisions], their minds have not traveled beyond their own company's interest to the retailer's warehouse."

A-3 "The manufacturer only considers package material costs [in design packages]. They ignore the rest of distribution system."

A-4 "Everybody [manufacturers] is cheating on case quality and sizes which overhang the 48 by 40 pallet....My personal opinion is that they couldn't care less about what we pay [in distribution costs]. They are concerned with their own profits."

A-5 "The distributor has paid for savings enjoyed by the manufacturer. A sore point is their disregard for standard unit load [48 by 40 inch pallet] program. Even though a smaller pallet was efficient for some items, distributors made the change. Manufacturers began overhanging the pallet by as much as 7 to 8 inches. The consequences were that our racks kept growing larger, occupying more cube in the warehouse....Distributors paid the bill for changes adopted by the manufacturer."

B. Manufacturers

B-1 "We slightly overhang the pallet in order to reduce damage--we need to have the unit load fit both the rail car and trailer."

B-2 "Of the 96 inch trailer width, only 91-92 inches is available. We can't put two pallets side by side, so we pinwheel them. However, we still have 4 inches left - so we design one or two inches of overhang to overcome this problem."

B-3 "If we [manufacturer] can do it [make package design improvements] to capture internal efficiencies, then this is a move in the right direction. But we won't spend 5 million dollars to suit the needs of the retail trade."

by noting manufacturers, since they deal with their own products and handle unit load quantities, aren't aware of the problems distributors face. Quotes A-2 and A-3 emphasize the lack of consideration of impacts beyond a manufacturing firm's boundaries. Comments A-4 and A-5 describe instances where, from the distributors' vantage point, manufacturers have made changes (decreased case quality or increased pallet overhang) to increase profits for themselves at the expense of increased costs for distributors. Several manufacturers described their reasoning (remarks B-1 and B-2) to lower their transport and damage costs. Several other respondents identified the underlying problem as being that the 48 by 40 unit load size did not fit transport carrier dimensions. Thus, many suppliers design their packages to better utilize transport vehicle space and lower their costs even though the pallet overhang creates difficulties for distributors and raises their costs. The final quote (B-5) indicates one distribution manager's interest in improving internal efficiencies and reluctance to undertake major changes, such as modularization which benefits the retail trade. The thrust of the comments indicates that existing institutions do not bring the effects on distributors to bear on manufacturers' package design decisions.

3. Lack of Competition Necessary for Cost Savings to be Passed to Consumers. Several manufacturer representatives interviewed brought up the level of competition among distributors as a potential barrier to incentives to improve package design. A fear was expressed that if a supplier made a package change and lowered a distributor's costs, that these savings would not be passed along to the retailer and ultimately to the consumer. The comments by three suppliers and one distributor in Table

7.6 illustrate this concern. These remarks revealed a reluctance of some manufacturers' to assist distributors because they believe that the distributor, not the consumer, will be the beneficiary. If this occurs, the reward to a supplier of a lower price for its product to consumers and potential increased sales is dissipated. A wholesaler respondent brought up the issue of lack of competition and cited previous examples where various participants had captured savings from innovations rather than passing them forward.

4. Distributor Behavior in Private Label Product Area. The issue of distributor behavior in the private label area was brought up during the interviews in several ways. First, several manufacturers and many distributors identified private label packages as troublesome. Second, the failure of distributors to make improvements and implement modularization in their private label products was cited by manufacturers as evidence of the small magnitude of savings in this area.

Distributors which were asked to comment about private label versus brand shipping packages responded in diverse ways. Thirteen interviewees indicated that there was no significant difference between the two product types. Seven distributors held strong views that in general private label secondary packaging was much more of a problem. Two others agreed there was a difference but that the implications were not significant for distribution costs. Five respondents indicated that size proliferation was greater in the private label area. Table 7.7 illustrates representative viewpoints from each category. In addition, a representative of a distributor trade association and a consulting firm also believed that in general, more shipping container problems for private label

Table 7.6 Interviewee Comments About Savings Being Passed to Consumers

A. Manufacturer

1. "Would they [retailers] pass the savings along. Say I run a warehouse, if I can increase efficiency and don't have to change prices, I can keep the benefits and congratulate myself. There is a need for this to be a two-step process-where the savings are passed along to the consumer."

2. "If we make a change which reduces their [distributors] handling cost by a nickel a case, the wholesaler will keep some of it for themselves. Sometimes we are selfish as well."

3. "Will the wholesaler or retailer grab it [savings from modularization] all? Nobody trusts anybody."

B. Distributor

1. "One other thing: does the consumer really get a benefit? In the past, savings from trucking changes and palletized loads were not passed on....The savings wouldn't get passed along to the consumer--unless the manufacturer forced it to be."

Table 7.7 Distributor Comments About Private Label and Brand Shipping Packaging

A. No Difference Perceived

1. "There is not a big difference between private label and brand [secondary packaging] either in terms of quality or number of sizes."

2. "There are no differences. Some manufacturers use almost the same containers [for their private label and brand items]."

3. "We have more leverage with them [private label vendors] so we can get what we want."

B. Strong Views that Private Label was Inferior

1. "In terms of package quality, we are the worst offenders of all. Buying is done on price."

2. "I hate to say it but packaging problems are worse with this [private label]. Packaging is changing all the time."

3. "The standing joke in the industry is that private label is one area where carton quality is worse. The merchandising arm of our company is trying to keep the price down [on private label products] to sell them cheap. The distribution end of the firm ends up paying the piper in higher costs."

4. "In the private label/generic area where we have complete control, we have the worst packaging. In private label you want to buy cheap.... The only place to cheat is on packaging. If you beef up packaging, you won't have the price spread between brand and private label."

C. Slight Difference Perceived

1. "There is not much difference between private label and brand packaging. Your case costs are less - you get a better price - as you gain clout with a supplier. Here [the shipping container] is one place you can cut to keep the price of the product low....We can accomodate the differences pretty easily in the distribution center."

2. "We [private label] want to price out cheaper than the national brands. For an independent packer supplying 4-5 companies to make a profit, he must reduce the advertising and quality of corrugated....It's pretty hard to pinpoint the shrink that you incur compared to the profit you make in private label."

D. Size Variation in Private Label

1. "In some categories, such as string beans, there are lots of changes [in size] since one manufacturer's equipment doesn't meet the standard of another's."

2. "There are more different sizes because we might carry three different private label brands."

3. "In private label, we do get variety in case packs such as 10, 12, or 14."

products. While the results are mixed, a significant proportion of interviewees perceived private label shipping packages to be inferior. Clearly, this observation needs to be further investigated and verified through a survey of actual products in addition to perceptions of effects.

Several manufacturer respondents argued that private label shipping packaging was of generally lower quality and presented greater problems in retail distribution than brand packaging. One manufacturer stated that it did use cheaper packaging for its private label in one product category. Two other suppliers indicated that they did not reduce quality for their private label products, but know of competitors that would or probably did.

Several reasons were offered as to why secondary packaging for private label/generics was a greater problem for some firms than brand packaging. First, private label buying is based primarily on cost in order to yield a retail price which is lower than the national brand. As quotes B-3, B-4, and C-1 in Table 7.7 indicate, one place where dollars can be saved is in the shipping container. Two manufacturers identified the extremely competitive nature for some commodity products in private label as a reason for reduced case quality. One supplier described the problem this way:

> A private label buyer will save money by playing one [supplier] off against each other to get a barebones price...Those [suppliers] not having the greatest resources will cut corners by reducing container quality.

Distributor remarks C-1 and C-2 in Table 7.7 also note the bargaining power relationships effect on cost cutting moves which result in poorer packaging.

A second issue relating to distributor private label behavior was brought up during the interviews. The issue is: Given that benefits to packaging improvements such as modularization exist, why don't distributors make such changes in private label? One distributor executive, who had been involved in many exchanges with suppliers about packaging, stated that manufacturers often responded to complaints with "why don't you clean up your act with your own private label items?" This respondent indicated that pursuing such questions was embarassing because he felt there was an awful lot more they could do in this area.

Several manufacturers and trade association officials interviewed reiterated the question: If there are so many benefits to modularization, then why don't the retailers implement it for their private label? Two instances were cited where a distributor had switched a house label item from bags to corrugated cases but was unable to sell it to consumers because the added cost made it uncompetitive. Two suppliers argued that the behavior of distributors with respect to private label packaging indicated the small magnitude of the savings possible from modularization. One executive remarked:

> The behavior of the distributor trade is highly logical. They would rather have a low cost product than the small savings possible through modularization. They instinctively know where to make money.

Distributors cited several reasons why the modularization was not occurring in private label products. First, the private label industry is a "copycat" or "me too" business which is not very innovative by its very nature. Second, several buyers stated that even though they have more control and leverage with private label suppliers, they refrained from requesting anything extra or unusual which would increase costs.

The objective was to obtain a better price, not to add to their expense. Pricing practices which affect incentives for improving private label packaging are treated in Section B below.

5. Threshold Level of Adoption Needed to Produce Savings. A small number of interviewees identified a characteristic of modularization benefits as an implementation problem. The characteristic was that benefits depended upon a critical proportion or threshold level of manufacturers adopting modular sizes. Interviewees remarks which identified this characteristic and drew implications for adoption incentives are presented in Table 7.8.

Quote B-1 gives the view of one distribution manager toward the size proliferation problem. The marginal decision to add one more size is seen as insignificant. Remarks B-2, B-3, and B-4 represent interviewees views on moving marginally in the other direction--one manufacturer standardizing its case. The thrust of these three comments is that one manufacturer alone can't make a difference, but acting as a group modularization will yield benefits. A leading manufacturer explained the same difficulty from its perspective and also emphasized the need for system-wide change (see A-1).

The implications of this characteristic of modularization benefits for adoption are discussed by respondents making remarks B-5 and B-6. The buyers' viewpoint expressed in B-5 pinpoints the problem inherent in individual market transactions for modular package adoption. Quote B-6 illustrates a distribution executive's viewpoint on the futility of working with suppliers on a one by one basis to implement modularization.

Table 7.8 Interviewee Comments on the Threshold Level of Adoption

A. Manufacturers

1. "The implementation of modular sizes over 15-20 years is a good trade objective, but we faced a dilemma. If Z [our firm] came in it with the modular system, there would be no benefit. There is a need for system-wide change."

B. Distributors

1. "Size [of cases] is not an important factor. There are so many sizes, one more doesn't matter."

2. "What difference would one manufacturer make? If it [standardization] was done from an overall basis, then it would make a difference."

3. "It [modularization] is an all or none situation - it doesn't matter that one manufacturer changes. You need an industry-wide effort."

4. "If everyone [manufacturers] changes, then all those benefits are there. One manufacturer alone can't reduce our costs."

5. "I wouldn't pay 5 cents more for a standard case. If just one company does it [standardizes], there is no difference. There aren't savings unless they (suppliers) all do it together."

6. "Modularization could provide a million dollars [in labor savings] annually theoretically for Z [our company]. The problem is the upfront cost in achieving it....You would need to work with a vendor at a time. Let's say you were able to pull it off with one firm in three months. Convincing one vendor to change is useless. You need to reach a critical mass, say 40 percent of [vendors] before any savings are gained."

6. The Horizontal Incidence of Effects of Case Size Diversity and Benefits from Modularization. Several distributors interviewed indicated that all distributors were encountering the same problems in terms of difficulties in handling the numerous case sizes. One buyer for a major wholesaling firm put it this way: "Everybody has the same problem. We are all passing the costs on to the retailer." Two respondents believed that the commonality of the shipping container problems had a dampening effect upon the incentive to one distributor to seek a solution. Their comments are below:

> Things are, as a general rule, equal between us [distributors] --products, prices, manufacturers' deals. My contention is that it doesn't matter how inefficient we are as long as all players go by the same set of rules. We all have to deal with the same crappy packaging, and are all equally in the dark about some superior packaging....Everybody plays with the same deck [in packaging] so the package is not terribly important.
>
> A reason nothing happens [in the area of modularization] is that nobody [wholesaler] has an opportunity to gain individually.

In the first quote, the fact that all distributors receive the same or "equal" packaging is argued to be a reason why firms don't pay significant attention to package improvements. Apparently, packaging is perceived as an area where a firm is unable to achieve an advantage over competing firms. The second quote specifically identifies the lack of opportunity for individual gain as a problem in adopting modular containers. Several other individuals that were queried on this potential incentive problem. The general response was that the sharing of the benefits of modularization was not an obstacle to its implementation. One executive emphasized his firm's willingness to support modularization collectively:

> Top management would push harder if it [modularization] was a chance to get one up on competitors...However, we are all going to share the cost of accomplishing the change through supporting and participating in the trade association study. This is an unselfish motive."

In sum, the sharing of benefits horizontally among competitors was viewed by some interviewees as a very significant factor and by others as less important.

B. Practices Documented During the Interviews

The literature led to the identification of several specific behavioral practices or standard operating procedures that were potential barriers to improved vertical coordination and the adoption of packaging improvements, such as modularization, to lower total distribution costs. Specific questions were asked of interviewees regarding: 1) distributor procurement practices; 2) distributor handling cost allocation; 3) interfirm transactional arrangements over damage costs; and 4) practices of suppliers and distributors relating to cash count.

1. Distributor Procurement Practices. Inadequate information flow between the distribution and procurement parts of wholesale and retail organizations as a barrier to modularization was discussed in Section 7.1.4.B. Evidence indicated that buyers relied on the criterion of gross margin and tended to ignore distribution costs related to product packaging. Documentation of buyer's practices was attempted. The evidence came from buyer's themselves, distribution managers in both retail/wholesale and manufacturing firms, and trade association officials.

The responses of buyers supported the literature review observation. Of eleven buyers interviewed, seven indicated that packaging-related distribution costs were not a criterion in their purchase decisions.

Two indicated that such factors were sometimes a criterion, but was very far down their list of concerns. The final two indicated that they were aware of warehousing problems and took these into consideration in their decisions. Buyers indicated that they based their decisions on the factors of sales potential, gross margin or profitability, and manufacturer promotional support. One respondent stated that the reason buyers are not concerned with distribution costs is that it is not something by which their performance is evaluated. Criteria commonly brought up as criteria for buyer performance were: service level to store (out of stocks), sales velocity (inventory turns), gross margins (cost of goods), and such subtle things as rapport with sales representatives and negotiating ability. One respondent explained that buyers couldn't make any money in packaging and were simply protecting themselves by not paying extra for improved shipping containers.

Additional comments made shed light on the intraorganizational communication difficulties. First, a theme which emerged was that the buyer was most attuned to the retail level and consumer. One head buyer interviewed said that his entire staff was brought up through the retail stores and was thus sensitive to retail store needs. He went on to say that some warehouse people lacked this sensitivity. Second, several buyers indicated they had a lack of knowledge and expertise in the physical distribution area. One respondent said buyers were dependent on distribution people voicing complaints about packaging. He further stated that the distribution people in his company had never explained the need for or asked for modular sizes. Several other buyers also thought communication between the two functional areas was sparse.

Almost all distribution managers interviewed held the opinion that buyers placed little or no weight on distribution costs related to packaging. Individuals in only three firms out of twenty-five where this question was pursued had a strong opposing view. The comments of the remaining twenty-two interviewees about problems of intrafirm communication fell into three areas. First, respondents perceived that buyers' decision making was made on gross profit or "bottom-line case costs" and that they avoided paying for any extras such as improved packaging. Second, interviewees noted that buyers were functionally oriented to procurement and were not interested in or concerned with distribution. Third, several others pinpointed the lack of awareness, understanding and a general inability of buyers to relate to distribution and the role of packaging in it.

Distribution managers in manufacturing firms also had commented about distributor procurement practices and their potential implications for secondary packaging. Their comments were primarily related to: 1) lack of buyer demand for modular sizes; 2) the inability to "sell" shipping container improvements which increased efficiency in wholesaler and retail chain distribution operations.

Several supplier representatives gauged the interest of the distributor trade as being non-existent based on their observation of the lack of buyer pressure for modular cases. Two interviewees recalled that the only size concerns ever raised were about cases which were too big. For example, large cases had presented problems for manual handling, due to their bulkiness or weight, or would not be conveyable through an automated/mechanized warehouse.

A few interviewees described the resistance they had experienced in trying to market package improvements which would improve handling in the distribution operations of wholesalers and retailers. One executive, whose firm had recently reduced the number of package sizes used to achieve internal efficiencies, indicated that in principle the idea was great, but the actual execution was difficult. He reported that significant resistance was encountered in distributor firms, even though potential savings existed for them. This executive concluded that it is very difficult to sell an innovation which enhances distributor productivity. One interviewee described this problem, emphasizing the buyers' role:

> We have never been able to sell something at a premium that was supposed to save them money...Procurement [in distributor companies] looks at the bottom-line case cost.

Several respondents further elaborated on the relationship between the procurement and distribution functions:

> It's hard to get them [chain stores] to accept change. It is difficult to get the buyer and warehouse manager to talk with one another.
>
> Buyers don't always talk to distribution people. They might consider case uniformity, if they knew about it.
>
> The distribution person in chain stores is not a major decision point. The merchandiser is.

In sum, manufacturers' comments add to the evidence that distribution costs associated with packaging are not an important consideration in distributors' procurement decisions.

A final category of participants, trade association officials, provided evidence on the degree to which buyers decision making was an obstacle to modularization. Four individuals in three associations were asked to respond to the following statement: An important reason for

the absence of modularization is that buyers do not consider distribution costs as a criterion in their decision making. Three of these officials wholeheartedly agreed with the statement. One comment indicated that there was a need for corporate management to better integrate procurement and distribution functions. The fourth official was less decisive, stating that some buyers do and others don't consider distribution costs, but leaned toward agreement with the statement. This person went on to point out that marketing plays a heavier hand in decisions in both manufacturer and distributor firms. Another trade official concurred with this, stating that in general: "the distribution part of our business has a weak voice."

2. Distributor Handling Cost Allocation Practices. In Section 7.1.4, food distributors' practice of cost averaging was described as a barrier to transmitting the necessary information and economic incentive to manufacturers to make package improvements and possibly its standardization. The use of this practice was verified during the interviews as a standard operating procedure used in the industry. A brief review of distribution managers' and buyers' comments are presented below. Also, implications of these practices which were drawn by representatives of distributor and supplier firms are presented.

Distribution managers reported that traditionally no attempts had been made to accurately measure and allocate handling and shipping costs to individual products. Wholesalers interviewed indicated that pricing to retailers was done on a cost-plus basis. Warehouse and transportation expenses were charged to their customers in a service charge or "freight and fees." Thus, any cost savings in distribution could be

reflected in a reduction in this charge, but would not enter individually into any one product's price. Chain managers generally reported that they did not break down distribution costs on a per product basis. (However, two firms were investigating the use of Direct Product Costing. See Chapter 8). For example, one executive stated that damage costs were spread across departments and products in his firm. Another stressed that costs were blended into the price of products so that each product received an average charge. Reasons offered for using this practice were the difficulty in measuring these costs and lack of an accounting system for allocating individualized product costs.

All but one of the buyers interviewed stated that their firms did not measure and precisely allocate distribution costs to individual products. Again wholesaler respondents emphasized that pricing to retailers was done on a delivered case cost basis and that distribution costs were charged in a separate account. Two wholesale buyers stated that most warehouses in the U.S. did not get that precise with handling costs and employed the cost-plus pricing procedure. Several chain buyers also concurred that warehousing and transportation costs for all grocery products were equalized or averaged in the pricing process. An extremely different view was expressed by a buyer for a retail chain. This individual stated that his firm was aware of the individual product handling cost and had been using Direct Product Costing for several years.

Only a few distributors and suppliers identified the linkage between distributors' pricing practices and suppliers' packaging decisions. First, on the distributor side of the industry, a retail chain distribution manager and a trade official recalled the experience of a paper manufacturer which had attempted to downsize its retail and shipping

packages to conserve space in storage and transport. Both interviewees pointed out the supplier encountered difficulty with retailer and consumer acceptance and lost its share of the market. The distribution manager, who also had some sales experience, noted that:

> Retailers, in the aggregate, had a difficult time. Some of the more sophisticated retailers saw the benefits [of smaller sizes] and attempted to reward the vendor at the retail shelf level. The vast majority did nothing at all...It's hard for a merchandiser to understand the correlation between case size and distribution costs.

The respondent added that only merchandisers, not distribution people, could reward vendors and since they do not understand the relationship between package size and distribution costs, they do not consider it in pricing. The trade leader interviewed concurred that most distributors did not reward this vendor in the retail store. This individual noted that, in his view, this supplier was bitter because it felt that if the distributor had backed them at store level the change could have been successfully implemented.

One supplier interviewed emphasized the lack of hard quantifiable data on distribution costs and its use in distributor decision making as a barrier to incentives for package changes. This executive was particularly critical of retailers' practice of using average margins to price products. It was stated that the common practice involves making up the invoice price by a standard percentage of the margin for a particular product category. This practice was criticized because package characteristics and quality vary and affect products' handling cost.

One interviewee used the following example to illustrate the implications of pricing practices for generic and brand products. First, the assertion was made that generic secondary packaging was of inferior

quality and thus incurred greater costs in distributors' warehouses than brand products. A standard markup for the category, say 3 percent, is applied to the invoice price of both product types in the category. Thus, the markup on a $30 case of brand product and a $20 case of the same generic item would be 90¢ and 60¢, respectively. The final retail price for the brand case would be $30.90 and for the generic case $20.60. The pricing method in effect increased the retail price spread between the brand and generic item. The interviewee argued since the generic product actually cost more than 60¢ per case to handle because of sub-standard packaging, the distributor actually lost money on the product. The respondent recommended that a more relevant measure of value added based on the actual quantified costs of handling different products should be used. This executive emphasized that no incentive existed for a supplier to change packaging until the resultant cost savings to distributors could be quantified.

3. Interfirm Transactional Arrangements Over Damage Costs. The literature review revealed that current practices for damage cost allocation between manufacturing, wholesale, and retail firms was a possible barrier to conveying the necessary economic signals to suppliers to improve packaging (see Section 7.1.4.A). In the interviews, respondents were queried about their standard practices for dealing with products damaged in distributors' warehouses. Based on the responses, there appears to be no one common method for dealing with damage. Some suppliers and distributors indicated that a "swell" or damage allowance was used for certain products while others said it was never used or encountered by their firm. Several insightful points were brought out and are

described below. One practice coming into greater use, the use of centralized spoils centers for returning products to suppliers is also discussed.

Three distributors interviewed made the point that only some distributors receive product damage allowances. Two of these interviewees went on to say that allowances are often used for things unrelated to damage. These allowances were reported, in some cases, to be used as a negotiated item and be used to give special consideration to a certain retailer.

Two distributors emphasized the magnitude of damage which is "masked" since it occurs at different organizational levels. It was pointed out by one interviewee that: 1) damage recognized on inbound shipments was the responsibility of the manufacturer; 2) damage found in warehousing and transport was typically hidden in allowances or credits unrelated to damage; and 3) suppliers' sales forces pick up some of the retailers' damage costs. Consequently, no one decision unit recognized the full magnitude of the damage problem. Another distribution manager indicated that under existing accounting and management systems considerable damage can be occurring in the warehouse without the buyer or vendor being aware of it.

Distributors reported that dissatisfaction with traditional arrangements had led to the development of centralized spoils reclamation centers. Six firms were currently using and several more were looking into the scanning of unsaleable damaged products to provide the necessary invoices for return sale to manufacturers. Exhibit 7.1 is a new product information form of a retailer operating a spoils program. At the bottom of the form the manufacturer is required to indicate its policy toward payment for damaged unsaleable products. Damaged products from stores,

NEW PRODUCT INFORMATION FORM

TO ALL SALES REPRESENTATIVES: UNIVERSAL PRODUCT CODE

VENDOR CODE					CASE CODE					ITEM CODE				

MAKE SURE ALL INFORMATION IS COMPLETE AND ACCURATE - SEPARATE FORM FOR EACH PRODUCT

DATE OFFERED: _____

ITEM DESCRIPTION: _____ PK/SIZE: _____ MFG. CODE: _____

MANUFACTURER: _____ TELEPHONE: _____

ADDRESS: _____ ZIP: _____

MANUFACTURER'S REPRESENTATIVE:

BROKER SALES: _____ TELEPHONE: _____

DIRECT SALES: _____ TELEPHONE: _____

ADDRESS: _____ ZIP: _____

COST PER CASE _____ SUGG. RETL. _____ MARGIN _____ FOB _____

FREIGHT _____ CS. WGT. _____ CS. CUBE _____ MIN. SHIPMENT _____

CASH DISCOUNTS _____ OTHER DISCOUNTS _____ LEAD TIME _____

SHIP VIA (TRUCK OR RAIL) _____ PRICE PROTECTION _____ GUARANTEED SALE _____

ADVERTISING ALLOWANCES: _____

PROMOTIONAL ALLOWANCES: _____

ADVERTISING BY SUPPLIER (DESCRIBE): _____

_____

COMPETITORS HANDLING PRODUCT	TEST	REG.	RETL	COMPETITORS HANDLING PRODUCT	TEST	REG.	RETL

IS THIS ITEM OFFERED TO OTHER SIMILAR DISTRIBUTORS ON PROPORTIONATELY EQUAL TERMS? _____ IS THIS ITEM GUARANTEED TO CONFORM TO: FFDA STANDARDS? _____ U.S.D.A. STANDARDS? _____

IS THIS ITEM COVERED BY PRODUCT LIABILITY? _____ AMOUNT? _____ DAMAGE _____ WAREHOUSE _____ RETAIL _____

DESCRIBE: _____

SPOILS PROGRAM

_____ We are utilizing your centralized system and will pay for items within our policy at retail or cost (circle one).

_____ Our Company intends to institute or has such allowance in New England of approximately ____% which approximates the average loss we have found to be unsaleable on our brands.

_____ Our Company is working at reducing unsalesbility on our brands via packaging, pack, corrugated, shipping, etc. etc. changes and will therefore be offering approximately ____% of the retail on the printouts in lieu of auditing the large quantities of unsaleables.

_____ Other (please state concisely):

Signature _____

Exhibit 7.1 Example of New Product Information Form of a Distributor Employing a Spoils Program

transport, and, in some cases the warehouse level, were sent to a central spoils reclamation center where products were scanned and prepared for supplier pickup. This operation was performed either internally by the distributor or by a specialized firm. Three distribution managers stated that the premise of the spoils center concept was that damage (which resulted in unsaleable products), wherever it occurred in the system, was the responsibility of the manufacturer. Several distributors using the system reported that the program's use had the effect of: 1) increasing their knowledge of the aggregate amount of damage and of specific categories and suppliers' products creating difficulty; and 2) shifting the cost of damage backward to manufacturers. Two executives thought the latter effect would result in better packaging. One respondent indicated that the program had also been helpful in identifying internal practices (e.g., use of razors to open cases) which could be changed to reduce damage.

Representatives of manufacturing firms noted that the precise tracking possible in spoils programs had awakened the distributor trade to the magnitude of damage costs being incurred but saw several shortcomings in such programs. Two respondents stated that the only firms using spoils programs were large chains with a power base. Respondents offered several different reasons why they were buying back their damaged products in spoils centers. First, they stated that they hated the impression of damage and their sales representatives has always taken back a certain amount of damaged or unsaleable products. Second, the threat of a chain reducing consumer access by being less receptive to new items or discontinuing present slow moving (marginal) ones was seen as a motivating force for some manufacturers that were not powerful marketing companies.

Third, suppliers bought back their damaged product as part of the negotiation process with customers to keep them happy.

Manufacturer respondents agreed with distributors that the spoils centers were forcing the cost of damage back to them, but identified problems with respect to the ability of such systems to generate incentives for package improvements. First, opinions were expressed that more products were being returned than they were responsible for. Factors such as worker error and slow movement of some products were pointed to as other reasons why a product might end up on a damage list in a spoils program. Second, a respondent stated that spoils programs are ineffective in creating incentives for manufacturers to improve packaging because the damage is not defined and its cause identified. This individual believed that more specific information on where and how the damage occurred was a prerequisite for manufacturers to alter package designs to lower damage incidence and costs.

4. Practices of Suppliers and Distributors Relating to the Case Count. A review of the literature indicated that the case count was a possible variable which could be manipulated as an alternative to the retail package to yield a modular package system. Suppliers have traditionally designed shipping containers in a dozen or its multiple. Wholesale and retail chain buyers are also accustomed to dealing in such quantities. Thus, a potential barrier to modular packaging would be a resistance of participants to changing their practices to accomodate more varied case counts.

Distribution managers in supplier companies and distribution managers and buyers were questioned about the extent of resistance to

changing case packs to permit modular shipping container sizes. The responses to this question are presented in Table 7.9.

Of seven manufacturers who responded in terms of their internal operations, five indicated that there would be resistance on suppliers parts to destandardizing the case pack. The primary reasons for this resistance were concerns about decreasing case pack size and thus reducing shelf allocation relative to competing products. Two-thirds of suppliers respondents commenting on distributor resistance believed that more varied case counts would be a problem for distributors. The major comment was that of distributors' concerns about increasing case counts due to the "forcing" more product on them than they could handle at retail level and also increasing inventory costs. The remaining respondents believed that there was little resistance by distributors based on experiences of their firms with changing case packs.

Distribution managers in wholesale and retail chain firms interviewed perceived few difficulties with new case packs for their firms. The use of computers in purchasing was pointed out to be the reason few problems were expected. One respondent believed that this potential barrier was a "paper lion" and that destandardized counts would not create a problem for buyers in the top 70 percent of distributor firms. Another stated that in general buyers shouldn't have problems but it was likely that some buyers would have difficulties. Three interviewees stated that buyers would have problems adjusting to new case packs. Several comments were made by individuals with positive and negative responses that destandardized case counts may create problems at the retail store level (e.g. inventory carrying costs, out of stocks) and thus meet resistance, two indicated that manufacturers would not want to increase

Table 7.9 Response to Question About Resistance to Case Pack Change

Sample	Resistance			
	Manufacturer		Distributor	
	Yes	No	Yes	No
Manufacturer	5	2	6	3
Distributor	6	1	4	17
Distribution Manager	2	1	3	10
Buyers	4	0	1	7

Source: Field interviews.

variability in case packs. One felt that increased variability would lead to smaller counts in order to reduce inventory costs. They believed such change would increase suppliers corrugated material costs and possibly reduce the amount of product displayed on the shelf, especially for "slow moving" products.

Most buyers interviewed perceived no problems with increased variety in case packs but felt that manufacturers would be opposed to such change. They expected that destandardization of case packs would be of little consequence to most buyers in the industry. However, several comments pointed to possible problems for traditional less sophisticated buyers. One chain buyer held a minority view that case count changes would be a significant problem because of the additional work necessary to work out equivalents. While most buyers expected few problems in the procurement departments, five respondents indicated that pack changes may have adverse impacts on the retail level. Concerns were voiced about increases in counts which would force more products than needed to the retail level or make handling difficult.

Four buyers believed that manufacturers were likely to be reluctant to produce more varied case packs. Concerns about having a case cost not out of line with competitors, the possibility of less shelf display and more out of stocks, and the resistance of production people to change equipment were given as reasons why manufacturers would be opposed to case pack changes.

A general picture of attitudes toward manipulating the variable of case count by referring back to Table 7.9. Manufacturer representatives perceived there to be greater resistance to changing case count in both their companies or the distributor trade. Distributors representatives,

including both distribution managers and buyers, generally perceived less resistance in their companies but believed that manufacturers would be opposed to such change.

7.3 Chapter Summary

Institutional factors, or behavioral rules and practices, affecting modular packaging adoption identified through a comprehensive literature search and personal interviews were described in this chapter. It should be emphasized that the factors, practices and processes described are what food industry participants perceive to be barriers to modularization. However, since the perceptions are those of persons knowledgeable of how the food industry operates, the results are very likely to be pointing to the more important factors affecting the adoption of modular packaging.

The common points between the literature review and interview results suggest the following as important institutional barriers to modular package implementation: 1) uneven benefit-cost incidence; 2) procurement and pricing practices affecting vertical information flow and coordination; 3) inability of competing firms to coordinate their actions; 4) potential negative effect on manufacturers' marketing flexibility; 5) potential constraints on technological innovation; and 6) the short-run orientation of food industry firms. The field interviews led to the identification of two important barriers which were not identified in the literature review. These were: 1) the relatively lower importance placed on distribution productivity then marketing goals; and 2) the diversity in the distributor trade and lack of agreement on desired package design changes.

CHAPTER 7

FOOTNOTES

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[74]A.T. Kearney, Inc., The Search for a Thousand Million Dollars (October 1966), p. 4.

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CHAPTER 8

INTEGRATIVE ANALYSIS AND INSTITUTIONAL DESIGN

The preceding two chapters have presented the empirical findings obtained through the literature search and field interviews. In this chapter, an attempt is made to: 1) analyze and integrate the key findings to arrive at conclusions about barriers to modularization; 2) identify forces driving industry change and assess their implications for modular package adoption and food system performance; and 3) design several institutional innovations for implementation of modular packaging and assess their feasibility and probable effects.

Analysis focuses on three major areas: 1) potential communication barriers between and across the manufacturing and distribution industries; 2) vertical coordination problems; and 3) industry-wide coordination problems. The implications of technological, legal and economic forces for modular package implementation are then assessed. Potential options for designing modular container systems are described and several institutional innovations designed to accelerate the adoption of modularization are presented.

8.1 Communication Problems

The literature search and interviews identified numerous instances where information about modular packaging and its effects appeared to be an important factor affecting modular packaging adoption. Several inter-industry and industry-wide communication problems are discussed below.

8.1.1 Interindustry Communication Problems

Communication difficulties including those arising from: 1) a lack of awareness of system-wide packaging problems; and 2) different understandings of possible solutions are discussed in this section.

A. Lack of Awareness of System-Wide Problems

Distributors manufacture a small percentage of the products they sell. Only the largest companies have integrated to a substantial degree into production of private label products. Intrafirm communication between the manufacturing and distribution functions has therefore been limited. Most communication between these two stages of the food system occurs through market transactions. Consequently, such transactions must be relied upon to communicate information about each other's operations and packaging inadequacies.

One observation of the interviews was that some distribution managers in manufacturing firms were not aware or did not appreciate the significance of the proliferation of container sizes for distributors' operations. Manufacturers, who typically specialized in one or more related product categories, identified instances where standardization already existed in their firms' product categories. Suppliers also handle larger quantities of products than the case-lot quantities often handled by distributors. Thus, the differences in the operational characteristics of suppliers and distributors is an impediment to participants' understanding of the problem of shipping container size proliferation. The problem of pallet overhang is a case in point. Manufacturers interviewed indicated that they overhang products to reduce transportation costs and damage incidence, but failed to mention its impact on

distributors' warehouse operations. On the other hand, many distributors complained about pallet overhang, but no interviewee specified the reasons manufacturers designed their unit loads to be larger than the 48 by 40 inch pallet base. It appears that neither party fully understands or appreciates the other's situation with respect to pallet overhang as well as other packaging-related problems.

A second observation is that communication between suppliers and distributors about shipping package deficiencies has been limited because market transactions occur between suppliers' sales representatives and buyers for wholesale and retail chain firms. Information is funneled through salespersons and buyers who, because of their training and general orientation to marketing and merchandising, are usually not well-versed in distribution matters.

The lack of understanding of each other's operations may be a factor contributing to communication breakdowns and conflict. For example, as noted in Section 6.2.1, some manufacturers perceive the problem of damage as primarily one of ineffective management and labor mishandling. Conversely, some distributors believe that the lion's share of damage results from manufacturers' inadequate packages. Thus, the lack of knowledge and understanding of each other's operations contribute to a polarization of views and inhibits the discussion needed to remedy packaging problems.

Manufacturers and distributors also communicate through trade association meetings and activities. Many trade meetings focusing on distribution operations have been jointly attended by representatives of both industry segments. Shipping packaging deficiencies and potential solutions (including modularization) have often been discussed.

However, many representatives of distributor firms expressed frustration with these gatherings. They stated that complaints were conveyed to manufacturers, but no changes in packaging practices resulted. Several company executives and a trade leader interviewed believed that progress was unlikely when discussion was confined to the operations level (e.g., between distribution managers in manufacturing and distributing firms). Awareness and involvement of top management at both industry levels were identified as prerequisites for substantial progress.

B. Different Understandings of Modular Packaging

In Chapter 6, it was noted that many participants had different ideas about: 1) what the term modularization meant; and 2) how a modular packaging system would be operationalized into a number of and specific sizes. For example, some manufacturers use the term "modular" to refer to unit loads of their own products mixed by layer. Buyers in distributor firms were also familiar with this definition. Distribution managers in wholesale and retail firms were generally more familiar with industry-wide standardization concept outlined in Chapter 4. The existence of different interpretations of modularization creates the potential for confusion and acts as a barrier to effective communication.

The different ways participants envisage modularization would be put into operation can also impede communication. If manufacturers expect that the modular system developed will have few sizes, they are likely to believe that it will severely limit retail packaging and thus impose large costs on them. Distributors having a view of a modular system with a greater number of sizes will expect that marketing flexibility will not be severely limited. In sum, participants' perceptions of the modular

concept's benefits, costs, and workability are likely to differ greatly. This can increase the difficulty of communication about modular packaging.

8.1.2 Industry-Wide Communication Problems

The diverse nature of the food manufacturing and distribution industries create the potential for industry-wide communication problems. The characteristics of a particular segment of the industry influences the problems and solutions which are perceived as significant. For example, manufacturers of lightweight products are more concerned with designing packages to occupy transportation vehicles and have greater concern about effects of standardizing the unit load size. Similarly, a distributor operating a mechanized warehouse may have different priorities for package improvements than operators of conventional facilities. Given the broad use and lack of specificity of the modular concept, it is possible for participants to selectively interpret it. In a heterogeneous industry, interpretations are quite different. As a result, the difficulty of industry-wide discussion is likely raised.

8.2 Interindustry Coordination Issues and Problems

The organization of this section draws heavily from the discussion of vertical coordination in Chapter 2. The process of harmonizing the functions in a vertical system was argued to have two levels of focus: synchronization and adaptation. Barriers to improved synchronization of the industry stages in the food marketing system are discussed in this section. In Section 8.3, barriers to industry-wide (i.e., horizontal) coordination needed for the food marketing system to adapt to improve its performance in the long-run are discussed.

In essence, the process of vertical coordination involves the matching of supply - production possibilities - with demand - the preferences of consumers. Improving this process in the synchronization sense involves fine-tuning the existing marketing channel and results in systemitizing, routinizing, and stabilizing the activities and relationships of various participants.[1] Institutional arrangements or mechanisms influence this process. Two fundamental types of vertical coordination mechanisms are markets and firms.

In light of the above, modular container implementation can now be cast as a problem of vertical coordination. Manufacturers currently make decisions about package size and institutions determine what they have to take into account and thus determine how well their stage is coordinated with others in the marketing channel. A key question concerns the ability of different institutional arrangements to coordinate the stages to improve performance of the system. Substantial evidence indicates that modular packaging could lead to a more streamlined, technically efficient physical distribution system and lower total costs. Since this innovation has not been adopted, it appears that existing institutional mechanisms are inadequate in their coordinative abilities. Specifically, they fail to bring the consequences of package design to bear on the people in manufacturing firms who make these decisions. Possible shortcomings of two alternative coordination mechanisms--markets and firms--for synchronizing the vertical marketing system are discussed below.

8.2.1 Economic Factors Affecting Exchange

In Section 2.2.1, a simplified conceptual model of modularization as a problem of exchange between manufacturers and distributors was

presented. Variables in several categories of factors which affect economic transactions are discussed below.

A. Demand Variables

The bid an economic agent is willing to make is a function of its income level and wealth, price of substitute goods and the price of complementary goods. If distributors can be conceptualized as potential bidders for the "good" of modular packaging, the above factors may explain the magnitude of the bid for modular containers. First, distributors' willingness to pay is affected by their wealth. A proxy measure of wealth is profit level. Several distribution managers and trade leaders interviewed believed that one reason that distributors would not pay more for modularization was the relatively low profit margins (generally less than 1 percent of sales for retailers) earned by distributors.

Second, the price of a substitute, namely electronic technology (i.e., information handling), for improving productivity has been steadily declining. Warehouse productivity has been increased through computer applications to labor monitoring, ordering and storage systems, warehouse layout, and warehouse order selection to increase cube utilization of loads. Elsewhere in distributor firms, electronic technology is being applied to scan UPC symbols and analyze sales data and more recently in computer to computer ordering of manufacturers products. It appears that availability of alternatives to improving productivity has been a factor reducing distributors' interest in pursuing modular packaging.

Third, the price of a complementary good to modular packaging, warehouse automation and mechanization, has increased. Interest in

modularization in the early 1970's appears closely correlated with the introduction of automated (vending machine) warehouses. Problems surfaced with these warehouses and four of nine firms that had installed these systems scrapped them by 1984 and incurred considerable losses. These experiences could be viewed as effectively increasing the price of a complementary product and therefore reducing the demand for modular packaging. They may have also reduced the willingness of any individual distributor to invest resources in innovative warehousing technology by demonstrating the costs of the risk involved. Firms are probably less likely to be willing to foot the bill for research, development, and fine-tuning automated systems since firms that adopt at a later point can gain from these efforts. "Free rider" behavior may be reducing distributor demand for automation and thus for modular packaging.

Also, the availability of computer technologies with much less capital outlay and greater return on investment to upgrade nonautomated systems has probably reduced demand for automated warehousing. Therefore, distributor demand for modular packaging has also declined.

B. Supply Variables

An important factor influencing manufacturers' willingness to supply products in modular containers is the cost of converting equipment. As noted in Chapter 5, the nature and magnitude of the effects of modularization on manufacturers have not been documented. Some have argued that conversion costs would be high,[2] while others believe that costs would be minor. In 1974, Milgrom and Brody appraised the conversion costs of modularization as follows:

> Considering that a typical supermarket stocks about 7,000 items, and that among these, about 2,000 different tertiary package [shipping container] size combinations are employed, the opportunity for modularization is excellent. Many of these secondary and tertiary packages differ by only minor size variations. Therefore, they could be relatively easily changed so that they could be grouped conveniently for distribution from warehouse to the retail store.[3]

In general, considerable uncertainty surrounds these costs.

The lack of operationalization of modular packaging adds to the uncertainly of its effects on food manufacturers. This uncertainty probably reduces their willingness to take steps leading to provision of products in modular containers.

Legal factors affect the costs of changing equipment to implement major industry-wide innovations. For example, the cost of UPC changeover were reduced since it coincided with changes in federal rules for nutrient labeling. In a similar way, the discussion and study of modularization in the early 1970's presumed that federal action on metrication would soon be forthcoming and that conversion costs would be reduced since changes would coincide with metrication of package sizes. However, after passage of the U.S. Metric Conversion Act of 1975, it became clear that metrication would be a gradual and voluntary process. Thus, modularization conversion costs were not lowered and manufacturers' willingness to supply modular packages did not increase.

8.2.2 Potential Problems With Market Exchange: The Viability of Exit

A party's decision to discontinue purchase of an item, or exit from a transaction, is the primary communication mechanism of the market.[4] For example, if some attribute of a firm's product declines, consumers

that refrain from its purchase reduce the firm's revenues. This provides a signal to the firm that something has gone awry. A firm wishing to recoup its losses would look for ways to improve the product to regain lost sales. This, in essence, is the disciplining mechanism of the competitive market system.

A number of problems can arise which reduce the effectiveness of exit as a way to communicate the information needed to improve performance. Problems occurring at the interface of the distributor buyer, (i.e., the consumers' representative) and the manufacturer are discussed in this section. Additional problems with the exit option at the distributor-consumer interface are covered in Section 8.2.3-C on distributor pricing practices.

The field interviews uncovered several problems with the exit option. At the top of the list of barriers identified by buyers and distribution managers in wholesale-retail firms was the inability of one firm to affect change. The common reason offered for this powerlessness was the inability of a single distributor to exit from transactions with strong marketing companies with established brands. For example, respondents often stated: "You can't say no to a Procter and Gamble or a Campbell's Soup." Consequently, exit is rendered ineffective as a mechanism for communicating dissatisfaction about packaging to manufacturers.

The problem of infeasible exit can be viewed several ways. First, a manufacturer that has successfully differentiated its product can be envisioned as a sole producer or monopolist. There can be no exit since no effective substitute product exists for a consumer or distributor. The inability of a distributor to employ the exit option can also be seen as a problem of individual versus group exit. No one individual firm can

refuse a suppliers' product for fear that consumers desiring the item will shop at competing stores that carry it. Thus, while all distributors may prefer improvements in packaging, such as modular sizes, no one firm is able to communicate their dissatisfaction with existing packages through exit.

The above situation appears to be a horizontal "micro-macro" problem where individual firm actions do not lead to results which are acceptable from an industry-wide standpoint. As noted in Chapter 2, Platt (1973) has coined the terms "social trap" and "social fence" for such phenomena.[5] A social fence is a situation where decision makers' emphasis on individual advantage inhibit actions which would result in benefits to the group. A distributor concerned about packaging fails to exit from transactions with a supplier with troublesome packages, even though such action would send a message to the supplier that an improvement in its packaging is warranted. The problem is more complicated since there are substantial penalties to a firm that alone refuses a supplier's product. This firm would stand alone without the product and competitors carrying the item could increase their sales and market share. Some competing firms may even seize upon the opportunity by featuring the item. Any one distributor is constrained by its competitors from communicating information to suppliers to make an improvement in packaging. No one firm is likely to be willing to act without some assurance that others will also act. Even though firms perceive the benefits of concerted group efforts to exit from transactions with suppliers having inferior packaging, the behavioral relationship existing in a competitive environment may prevent them from employing this option. As the number of firms becomes small, firms increasingly recognize the

interdependence of their actions and are more likely to pursue a group goal.[6] However, antitrust laws in the U.S. place constraints on this type of activity in the marketplace. Consequently, the viability of the exit mechanism is cast into serious doubt.

In the above discussion, modular packaging was treated as an ordinary package improvement. However, there are characteristics of this problem that make transmittal of information through exit particularly difficult. Exit from the effects of shipping container size proliferation is not really available. A distributor can refuse to buy one manufacturer's product if it is an unusual or nonstandard size, but thousands of other nonuniform containers remain that affect its operation. Exit from a transaction with one supplier does not enable a distributor to escape from the effects of case size proliferation. Second, a more practical problem is that no modular sizes have been chosen. Consequently, there is no way for a distributor to identify a "nonstandard" case and to refrain from the purchase of it. This problem is discussed further in Section 8.3.1.

8.2.3 Organizational Goals and Intrafirm Coordination

Performance of the vertical marketing system depends upon intrafirm (organizational) coordination as well as interfirm (market) coordination. The interview results indicate that a common intrafirm coordination problem exists in supplier and distributor firms. The root of this coordination problem involves firms' goals and the translation of these goals into an organization's structure and practices. A key question is: Among the many functions performed, where does a firm perceive that it makes its money and therefore place emphasis? In the food industry, firms

have viewed the heart of their business to be sales and have place relatively higher priority on marketing and merchandising than physical distribution functions. One trade association leader interviewed stated it this way: "Operations, such as distribution, are a servant of a sales organization." The implications of this organizational relationship for supplier package design and distributor procurement decisions are discussed below.

A. Manufacturers' Package Design Decisions

The driving force in manufacturing firms is marketing. With the leveling off of population growth, most progressive manufacturers have recognized that they cannot be successful by merely being low-cost producers, but must actively market their products. The retail package has been a key vehicle for accomplishing these objectives. Marketing departments and specifically product managers have made decisions about retail package shape and size largely based on supermarket and consumer-related factors. Shipping containers are then designed to enclose a certain quantity of retail packages. While there have been exceptions, distribution departments handle the package sizes given to them by marketing and have generally had little input into package design decisions. The effects of package design upon distribution operations are not an important criterion in product managers' decision making. Consequently, the lack of coordination of these two functional areas of manufacturing firms results in missed opportunities to lower total firm costs. For example, some container sizes do not occupy available space in homogeneous unit loads of product thereby adding to storage and transport costs. It appears that intrafirm coordination problems are impeding the adoption of package design changes that could lower manufacturers' internal costs.

B. Distributor Procurement Practices

The goals of an organization are accomplished by creating an incentive structure for individuals performing different functions. In distributor firms, top management has emphasized the retail store level. Procurement and merchandising which, focus on meeting consumer and supermarket needs, are functions that have taken on primary importance. Buyers occupy a pivotal communication role within the firm and between the distributor and suppliers. Therefore, their practices, which are conditioned by the organization's reward structure, intimately affect intrafirm and vertical system coordination and performance.

The literature review and interviews provided considerable evidence that buyers do not consider products' secondary package-related characteristics that affect handling and shipping costs as a criterion in their decisions. As noted in Section 7.2.2-B, buyers' decisions are based on a product's gross margin, or merchandising factors such as manufacturers' promotional support. Buyers were found to be evaluated by gross margin, sales velocity, and retail store service level.

Buyers' procurement practices have important implications for manufacturers' incentives to make package improvements. A manufacturer interested in lowering its product's cost to consumers may consider a package improvement that facilitates handling in distributors' operations. However, the manufacturer would probably find few buyers receptive to the change if it increased the product's price. Since buyers' performance is often evaluated by the gross margin or gross profit, they are reluctant to purchase products costing more due to better secondary packaging, even though the added costs may be greatly exceeded by handling cost savings in the distribution department of the company. In sum,

given the basis for buyers' decision making, no manufacturer has an incentive to make package changes, such as modularization, that would lower distributors' handling and shipping costs. Thus, buyers' practices act as a barrier to coordination of suppliers' and distributors' activities and to improved performance of the food system.

8.2.4 Barriers to Improving Intrafirm Coordination

Specific practices were described above that impede the intrafirm coordination needed for improved performance of the firm and the overall marketing system. Removing these barriers should improve a firm's bottom line profit. This raises an important question: Why don't firm managers, particularly top executives, attempt to remove these barriers in order to capture the savings? Two answers are postulated below.

A. Organizational Slack

As noted in Section 2.5.3-C, organizational slack or "X-inefficiency" is a potential barrier to intrafirm coordination. In situations where competition does not provide the discipline, firms may sacrifice technical efficiencies and devote resources to the satisfaction of other goals such as maintaining good interpersonal relations.

Imperfect competition leading to organizational slack may be an important reason why manufacturers have not attempted to capture efficiencies through standardization or distributor buyers have not accepted improved packages that reduce the firm's overall costs. Some evidence found in this study supports this hypothesis. For example, the literature review and the interviews indicated that costs of shipping container inadequacies, such as damage, were viewed as a "cost of doing business" and were simply passed on to the next stage in the marketing channel.

Competition may not be sufficient to induce firms to change decision making practices (e.g., package design or procurement) so as to lower the firm's overall costs.

B. Inertia of Decision Making Practices

An alternative reason why firms do not capture the benefits of improved intrafirm coordination concerns the nature of decision making. As argued in Section 2.5.2, firms employ SOPs to reduce the transaction costs of making collective decisions in a complex uncertain environment. Once developed, SOPs tend to be fairly stable since a change will involve transaction costs. Consequently, the inertia of SOPs can act as a barrier to changes in decision practices that would improve intrafirm coordination.

The inertia of existing industry practices surfaced in the interviews as a barrier to implementing modular packaging. The most commonly cited example was that of top management's inability to control and coordinate the firm's various functional activities. Distribution managers in supplier and wholesale/retail chain firms indicated that involvement of chief executives, not just operations people, was needed for undertaking a major system-wide change such as modularization.

Several interviewees identified a problem of intrafirm coordination in attempting to bring a program of change into effect. specifically, a top manager may decide on a new policy for his/her firm, yet due to the existing organizational structure and incentives and the ingrained practices of people at lower levels, cannot effectively implement the plan. Schon's conceptualization of behavior at the periphery diverging from central policy is applicable here. Top management's viewpoint and interest may lead it to impose an overall policy while persons

at the periphery will act according to their localized perceptions and interest.[7] A prime example is the difficulty top managers face in attempting to get buyers to consider package characteristics which influence costs in physical distribution. The following comment by T. Hammonds, Senior Vice-President - Food Marketing Institute, illustrates the problem:

> A manufacturer might then make a change in his shipping containers for the sake of efficiency and find distributor chief executives ecstatic, but buyers absolutely unimpressed. Even if that product is favored by company directive, it is likely to fade over time because there is no ongoing system to reinforce buyer behavior. Under these conditions, it would be irrational for any one manufacturer to undertake the steps which could ultimately lead to modularization.[8]

The quote not only points to top managers' difficulty in implementing policy at the periphery, but also emphasizes the need for a change in the control or reward system. Thus, careful attention must be paid to details of the organization's incentive structure to achieve the behavior desired at the periphery.

The center-periphery distortion has implications for cooperative ventures between and among industry sectors such as modular packaging. Top managers may agree in principle, but actual implementation depends on people at the periphery. While a chief executive's decision may have good intentions, the actions taken by lower level decision makers will be what others watch. If any firms are observed to not be following an industry-wide move toward modular sizes, the movement could break apart. One interviewee cited the demise of the pallet exchange program (see Chapter 4) as a problem of this sort. This person indicated that lower level employees of some distributors were responsible for "cheating" other participants out of pallets despite the fact that the firm's top managers wholeheartedly endorsed the program.

8.2.5 Intrafirm Information Handling: Distributor Cost Allocation Practices

The interview and literature search revealed that distributors typically do not know the cost of handling and shipping individual products and therefore do not precisely allocate such costs to product prices. Reasons for this practice are explored and implications for vertical coordination and the adoption of package changes which could improve food system performance are discussed below.

Information about the cost of distributing one product through its operation is not easily obtainable by distributor decision makers for several reasons. First, firms carry between 4,000 and 8,000 different dry grocery items. The contribution of one product to the total warehousing bill is not easily determined. Second, the effects (e.g., damage, reduced labor productivity, and wasted transport space) of packaging inadequacies also have multiple causes. For example, workers' training, their motivational level, and the abilities of managers also affect labor productivity. Thus, it is difficult to determine the degree to which packaging is the culprit in increasing warehouse costs.

Third, the point at which packaging inadequacies create problems and where the consequences are detected in the distribution channel are often different. For example, a packaging deficiency might cause damage at the warehouse loading dock, but may not be detected until the case is opened in the supermarket.

Together these factors increase the information costs of packaging inadequacies. A distributor may know that a particular package type is damage-prone, but the cost of obtaining information on the magnitude of the problem is prohibitive. Information on the costs of handling and

shipping an individual item is impacted within a functional area of the firm and is not available to coordinate activities in other parts of the company and the marketing channel.

Impacted information on costs of distribution inhibits vertical coordination and acts as a barrier to the adoption of package improvements in several ways. First, since the costs of handling an individual item are not easily measured, this information is not available for use in product decisions. For example, if a buyer knew the handling cost associated with carrying an item, his/her choice of products may be affected. Exit from products with high handling costs would provide a signal to manufacturers to make package changes to lower their products' handling costs and regain lost sales. Impacted information about handling costs is a barrier to the market signal necessary for improving vertical system coordination and performance.

Second, impacted information affects coordination through product prices. This discussion has thus far ignored the fact that consumers are the ultimate purchasers of suppliers' products. Since consumers are interested in increasing their real wealth, they prefer lower food prices. If the price system is working effectively, it should allow the articulation of these preferences. Distributors are located at a strategic point of information transmittal in the marketing channel. Their pricing practices are critical to conveying information and incentives necessary to coordinate the vertically-aligned stages to provide the goods desired by consumers. In order for prices to perform their coordinative role, distributors must set them so that they accurately reflect differences in the value-added of products. A manufacturer's product should be priced higher if its container creates relatively higher handling and shipping

costs than other manufacturers' products. Therefore, if a manufacturer is interested in increasing its products' sales, it would have an incentive to improve its packaging (thereby reducing the handling costs of its product) since consumers are likely to purchase more of a lower-priced product.

There is considerable evidence that distributors do not price products to reflect actual costs and as a result the potential market signal to manufacturers to improve packaging is short-circuited. The empirical results of Chapter 7 indicated that distributors do not identify, measure or allocate handling and shipping costs to products on an individualized basis. Because information on the individual cost of distributing products is costly to obtain, distribution costs are factored into prices on an average basis. As a result, consumers face prices which do not reflect products' true costs. They are therefore unable to discern which products have shipping containers that incur relatively higher handling and shipping costs and thus do not exit from the purchase of such products. As a result, the potential market signal of lost sales (from the exit of consumers) that would have been sent to manufacturers of products with inadequate shipping containers is muted by distributor pricing practices. As currently instituted, the price system does not allow consumers to express their preferences for lower-cost products that would result from improved shipping containers.

The effect of impacted information upon vertical coordination can be examined from a manufacturer's perspective. Distributors' pricing practices affect manufacturer's willingness to offer products in improved shipping packages. As noted, the fee for distributing a product is allocated independently of its actual cost. From a manufacturer's standpoint

there is no incentive to incur the added cost of improving shipping containers since the resultant savings in distributors' operations would not lower its product's price relative to other suppliers. Instead, the savings from the package improvement would be reflected as a slightly lower level of general costs for all products.

Distributors' pricing practices may also produce perverse incentives which can lead to greater aggregate costs in distributors' operations and higher prices for all suppliers' products. Given the existing pricing practices of distributors, a manufacturer can cut their own internal costs by reducing shipping container quality or other characteristics which facilitate handling and not be penalized by having its product's price increased. The package change will increase the aggregate level of costs for a distributor and each suppliers' product price will be raised slightly. However, the internal cost savings from the package change to the manufacturer are concentrated while the consequences (increased distributor costs and product prices) are diffused among many suppliers. If each manufacturer follows its own individual interest and decides to make such package changes, the aggregate cost of distribution for wholesalers and retailers will rise substantially, thereby increasing significantly the prices of all products. This phenomenon has characteristics of a "social trap" where suppliers, each pursuing their own individual objectives, produce longer-term results (higher prices) which are detrimental to the group's welfare.

8.2.6 Distributor Incentives for Modularizing Private Label Products

Since distributors would be the primary beneficiaries of modularization, the following question is raised: Why don't they implement

modularization for their private label products? As noted in Section 7.2.2-A, some manufacturers have concluded the fact they have not done so provides evidence that the benefits of modular packaging are unsubstantial. Possible reasons for distributors' failure to implement modular containers in their private label product lines are discussed below. First, factors identified by interviewees are reviewed. Second, problems with market contracting are discussed. Additional industry-wide factors affecting distributors incentives to change private label items are in Section 8.3.2-E.

Two factors were cited by interviewees as reasons why private label products were not modularized. First, private label buying is based on cost in order to have a retail price lower than brand products. Buyers tend to resist purchasing any extras such as improved packaging since it increases manufacturers' price to them, and therefore raises their product's price relative to brand products. In addition, distributors practice of averaging handling costs into product prices implies that savings in handling costs resulting from the package improvement will be diffused among many products and not directly reflected in the private label product's price. Given existing pricing practices the total effect of improving private label shipping containers would be to reduce the retail price margin between these products and their counterparts and therefore negatively effect the distributor's market position.

Second, private label is not an innovative area of the food manufacturing business. Private label products are designed to imitate brand products. In addition, private label products are often made by the same firms that manufacture brand products.

The adequacy of the market for executing transactions for modular private label products is called into question for several reasons. First, there are typically multiple suppliers for a given distributor private label product and buyers often switch among them in order to obtain a low price. Second, one distributors' request for modular package size implies that special changes to a manufacturer's operation would be needed. These idiosyncratic investments when accompanied by certain behavioral modes are argued by Williamson to make market contracting difficult.[9] If a manufacturer changed its operation to produce modular sizes for the distributor, it would become more dependent on that distributor. Assurance of a continuing relationship with the distributor is needed. Williamson argues that long-term contracts could be developed to provide this assurance but bounded rationality and opportunistism prevents such contracts would be unworkable.[10] He concludes that some other institutional mechanism than the market, possibly firm (hierarchical) organization, which can attenuate opportunism is needed. Vertical integration into manufacturing of private label products is discussed in Section 8.3.2-E.

8.3 Industry-Wide Coordination Issues and Problems

The previous section focused on barriers to improved synchronization and streamlining of the existing food marketing system. This section focuses on the abilities of the marketing system to adapt to major changes or innovations so that its long run performance is improved. A key proposition is that the adaptation process depends on the industry-wide (i.e., horizontal) coordination among firms. Barriers to industry-wide coordination in the market and in through trade associations are analyzed in this section.

8.3.1 Horizontal Incidence of the Benefits of Modularization

Modular packaging would produce benefits that will broadly accrue to participants at each horizontal level or, more technically, have a high cost of exclusion. Two ways in which the horizontal incidence of benefits may affect incentives for implementing an industry-wide innovation are discussed below.

A. Distributors' Actions to Implement Modular Packaging

The actions available to distributors to implement modularization are constrained to the voice option. Exit from suppliers' packages which are non-modular is infeasible due to: 1) the market power of established brands; 2) the lack of manufacturers' offering modular sizes which could be substituted for the product which was refused (which is a consequence of the absence of established modular sizes); and 3) the inability to avoid the overall problem of shipping container proliferation by refraining from purchasing one manufacturer's product. The alternative option for a distributor to express preferences for modular containers is voice. The incentives to a distributor to use this option are discussed below.

The use of voice by a distributor to implement modularization has benefits and costs. The nature of these benefits and costs determines whether efforts to articulate preferences through voice will be forthcoming. Consider the horizontal incidence of the benefits of voice. If a distributor complains about size proliferation and convinces a supplier to change to modular sizes, it makes an option available to all distributors. The benefits of having a modular package size available cannot be excluded from any distributor. Even if the product is higher priced, the option of having the modular size available is the result of the

distributor's action to exercise voice and it is enjoyed by all distributors.

The cost of a distributor's effort to communicate to suppliers to change packaging must also be considered. However, it is the only option available in the case of container size proliferation. In addition, the cost of voice is concentrated on the firm which complains. A distributor, weighing these narrowly focused costs against benefits that are diffused among firms due to their high exclusion cost nature, is unlikely to employ the voice option. In other terms, distributor action to bring about modular packaging is unlikely because the costs exceed the benefits of this action.

The behavioral phenomenon described above--where micro decisions produce undesirable macro results--has been explained in several ways. Schmid emphasizes the connection between individual effort and enjoying the good in question. High exclusion cost goods can be used by individuals without their having to contribute to the costs of its provision or maintenance, thus creating the possibility that noncontributors can act as "free riders."[11] Olson stresses the role of group size as it affects individual behavior and argues that in large groups where rational individuals share a common objective, there is in general no incentive for them to voluntarily contribute to furthering the objective.[12]

A specific type of individual-collective problem or "social fence"[13] appears particularly applicable to an individual distributor's incentive to use voice. Distributors considering their individual advantage fail to incur the costs of voicing preferences for modular packaging. The aggregate result is that no action is taken which could move forward an innovation which could make all distributors better off by lowering their

costs. In other terms, individual rationality is not synonymous with group rationality.

The explanation of distributors' behavior just outlined is really a hypothesis. Several authors have found a certain outcome (performance) is likely when participants are placed in a particular environmental and institutional setting (structure). In this case, the outcome is the lack of effort by distributors to communicate preferences for an innovation with substantial benefits for their industry. This outcome needs to be explained. The environmental conditions (e.g., high-exclusion cost good, large group situation) and behavioral assumption (self-interest) of the micro-macro theories discussed appear to exist in the food industry. Thus, the theories provide insight as to what forces are preventing modularization from being implemented. Empirical evidence is needed to verify this hypothesis.

The literature review provided support for the hypothesis outlined above. A panel which investigated the food industry for the NCOP found that lagging adoption of industry-wide innovations (including standardized packaging) which would increase the productivity of every firm was due to the fact that such innovations offered no advantage to one firm over any other.[14] [See Section 7.1.5.]

Findings from the interviews were mixed. Several respondents held the view that modularization and packaging in general was not an important issue because all firms received the same packaging and there was little opportunity for individual gain in this area. [See Section 7.2.2-A.6.] Two distribution managers in retail chain firms made remarks which support the micro-macro hypothesis described earlier. These individuals believed that the benefits of modularization were substantial

and they fully supported the concept, but indicated that they would not devote their firms' resources to its implementation. One respondent stated "If someone took a poll, I would vote for it, but I am not in the position to devote time to it." Similarly, a supplier representative indicated that he was personally for modularization because of the potential savings for the consumer, but would not advise his company to take action to implement it. Thurow's distinction between personal-private and individual-societal preferences seems applicable here.[15] Distributors may hold individual-societal preferences for modular packages, but only express their personal-private preferences in economic transactions with suppliers. In other words, distributors may have preferences for new "rules of the game"--such as a better way to package products. Yet, when it comes to playing in the existing economic game, they express their personal-private preferences and attempt to further their interest in this game. The distinction made by Thurow suggests that there are difficulties for the expression of individual-societal preferences through the market and therefore provides insight into why distributors fail to articulate preferences for modular packages to manufacturers.

B. Incentives to Implement Industry-Wide Innovations

In a theoretical world of perfect competition, zero transaction costs and omnicient participants, one would expect firms to undertake cost saving innovations regardless of how the costs and benefits are distributed vertically among industries.

If the theoretical assumptions are met, modularization would provide benefits to major participants that would serve as an incentive for adoption. Distributors who purchase modular containers would reduce

their handling costs and thus increase their profits. In the longer term, as modular containers gain widespread use, competition will compel distributors to pass cost savings forward to consumers. Distributor firms would still receive a normal return for their efforts in a competitive industry.

Reduced retail prices provide a benefit not only to consumers but to manufacturers and distributors. Lower prices for dry groceries should increase consumer purchases and expand manufacturers sales and, possibly, revenues and profits. Similarly, reduced product prices should increase the volume of sales through supermarkets providing a possible benefit to distributors. For instance, consumers may purchase more supermarket products and reduce away-from-home consumption as supermarket prices fall.

In the food industry, the theoretical assumptions enumerated above are not met. Therefore, the necessary incentives for adoption of cost-saving innovation may not develop. Several possible impediments relating to the horizontal relationships among firms are discussed below.

First, the competition at the distributor level where the innovation has greatest impact may be insufficient to ensure that savings are passed along to consumers. Consequently, the reward to a manufacturer of increased revenue through a lower product price is dissipated. This concern was expressed by several interviewees from both manufacturing and distributing firms.

Second, awareness of the competitive forces which would, over the long term, diminish profits from a cost saving innovation may weaken the incentive for the adoption of an innovation. For example, a distributor might implement a cost saving innovation, only to find that its profits were short-lived because other firms followed suit and competition drove

prices and profits down. However, it would still expect to receive a normal return on investment. In situations where firms are aware of each other's actions, there may be a greater tendency to refrain from undertaking innovations because of a knowledge of the longer-term result. Thus, the lack of adoption could be the result of recognizing this interdependence. It also implies that competition is not intense since cost containment pressures are not great enough to force firms to consider undertaking innovations.

Third, the high exclusion cost nature of the benefits of modularization may reduce the incentive for any single firm to invest resources to implement modular packaging. After a modular packaging system is implemented, the benefits for each participant would be shared across a horizontal level. Distributors should, at least in the short-term, enjoy increased profits. Even in the long-term, as most or all savings are passed to consumers, the resultant lower prices should expand distributors sales volume. Similarly, lower prices should increase manufacturers sales. Since these benefits would be jointly shared by firms at a horizontal industry level, the incentive for any one single firm to act to achieve the savings may be reduced. As Olson has demonstrated, rational individuals in large groups do not necessarily act to achieve a group goal.[16] Since benefits are shared, a participant may have the incentive to act as a "free rider" and let other firms sacrifice to obtain the group goal. If all firms act in this strategic manner, no action to achieve the jointly shared benefits of an innovation such as modularization will be forthcoming.

A related problem exists for system-wide innovations which was touched on in the Section 8.3.1-A. Even if the innovation produces a

savings to all participants competing at a horizontal level, firms may not be interested in implementation because there is no opportunity to improve their position relative to their competitors. The competitive market system fosters the pursuit of individual advantage and appears not to provide a mechanism for the articulation of preferences that would advance the collective welfare of the group.

8.3.2 The Need for Coordinated Supplier Adoption to Yield Benefits to Distributors

An important characteristic of industry-wide innovations such as modular packaging is that they are non-marginal. That is, all or most participants must change in order for anyone in the system to achieve any benefits. A "critical mass" or threshold level of participants must adopt modular packages for any savings to be generated. This situation creates several problems for implementation.

As explained in Section 2.6.3, the incentives to a single firm to act can be substantially reduced since it cannot produce any effect alone. If everyone were to undertake the change, then the firm would be assured of a benefit and thus willing to incur costs. Therefore, there is a need for coordinated adoption, or at least an assurance that the change will be widely adopted, for firms to be willing to invest in this innovation.

Modular packaging and other food industry innovations (e.g., UPC symbol) exhibit the characteristics of the situations described above. However, these examples are more complicated since manufacturers are the decision makers who incur the costs of the change and distributors are the primary beneficiaries of the innovation. Thus, achieving the benefits of the modularization is just not a matter of coordinating efforts at one horizontal level. Rather, implementation involves both

coordination between as well as within the manufacturing and distributing sectors. Problems for implementation through individual market transactions are discussed below.

A. Inability to Capture Benefits Through Market Transactions

Because of the existence of a threshold, no manufacturing firm that packaged its products in modular sizes would reduce wholesaler and retail chains' distribution costs. One supplier and six distributors interviewed acknowledged the existence of this threshold. [See Section 7.22-A.5.] Distributor comments indicated a lack of interest for one manufacturer's products in modular packages. If a manufacturer were to incur the cost of changing a product to a modular size, it would not be able to recoup these costs in a higher price since distributors would not be willing to pay more. Thus, a manufacturer is unlikely to adopt modular sizes because it is unable to capture the benefits of doing so through market transactions with distributors.

B. Interdependence Among Buyers Created by Economies of Scale

Even though distributors know that one manufacturer's adoption of modular sizes is a step toward reaching the threshold point where savings to distributors begin to be realized, they are unlikely to be willing to pay additional amounts to that manufacturer. Schmid's discussion of interdependency between buyers[17] and sellers[18] under conditions of economies of scale provides additional insight into this behavioral phenomenon.

Schmid notes that declining average production costs per unit is a source of interdependence among buyers of a product. The reason for this is that price of a good to one buyer depends upon how many other buyers desire it. In the case of modular packages, a distributor may

refrain from purchasing one supplier's product in a modular case because of an uncertainty about how many other distributors will also buy the modular package. If a distributor could be assured that a sufficient number of other distributors would purchase the manufacturer's modular size to reach a lower point on the cost curve, it would be more likely to express a preference for the modular size. In this case, the ability to reach a lower cost may not be the most important effect. Rather, the large-scale purchase of the modular product (and exit from alternative products) could serve as a signal to other suppliers to switch packaging, thereby moving the number of modular products closer to the threshold point where savings to distributors are produced.

Economies of scale can also be used to explain interdependence among suppliers. Schmid outlines several situations where substantial discontinuities in the cost function create investment coordination problems.[19] The concept of cost discontinuities is analogous to the threshold level of modular products needed for distributor savings to be realized. If that threshold point can be reached, the resultant savings will cause distributors to switch to modular sizes. The fundamental problem facing suppliers in their investment decisions is similar to distributors' purchase decisions. That is, in order for one supplier to convert to modular sizes, it needs to know if a sufficient number of other manufacturers will also change so that the threshold will be reached. The decisions of one firm clearly impact another. Some type of coordinative arrangement or agreement is needed to assure the modular system will be widely adopted before one supplier will act.

C. Implications of the Adoption Threshold on Distributors Use of Voice

The need for a threshold level of manufacturer adoption of modular packages for savings to accrue to distributors reduces the incentive for distributors to express their preferences through voice. In situations where a large number of different products are purchased, the cost of the time a buyer will spend trying to correct problems with any one of the firms it transacts with is likely to exceed the expected benefits of such action.[20] Each distributor purchases thousands of products from hundreds of different manufacturers. Each suppliers' product contributes to the shipping container size proliferation problem. A distributor must communicate with many or most suppliers. The benefits of such complaints depend on the successful conversion of the critical proportion of suppliers to modular sizes. Therefore, a distributor weighing the cost of voice, which are substantial, against its expected benefits would probably not elect to employ voice to foster implementation of modular packaging.

In Section 7.2.2-A.5, a distribution manager for a leading retail chain stressed the futility of using voice. The manager pointed out that his firm could work with one supplier at a time and predicted it would take about three months per manufacturer to accomplish change, but no benefits would be received until a threshold level of 40 percent of the vendors adopted modular sizes. This respondent also emphasized the role of risk and stated that while distributors were aware of the benefits of modularization they did very little to achieve it because they discounted the benefits by the probability of achieving results. Two risky aspects of devoting time to working with manufacturers on modular conversion noted were the uncertainty as to: 1) whether enough suppliers would

change to result in benefits; and 2) whether enough competing distributors would purchase modular sizes. The risk for one firm taking action resulting from participant interdependence is summarized in the following quote:

> Our firm's ability to get a return from efforts on modularization depends upon the action of so many different people. Considering the return on investment, such efforts don't compare favorably with internal innovations from which we know we can obtain a certain amount of benefits since we are autonomous.

D. Distributors' Time Horizon

One factor identified in Section 7.2.1 as a barrier to modularization by interviewees was the short-run focus of the food distribution industry. In light of the adoption threshold, this short-run orientation has important implications for distributors' willingness to incur costs to advance modularization. Because a critical proportion of products must be modular before savings are generated, a time delay will exist between a distributor's effort and a response. If the threshold is quite high, the delay may be significant and benefits may be far off in the future. Given the short-run time horizon of distributors, they are likely to heavily discount the benefits which will occur in the future. Thus, the perceived benefits are unlikely to exceed the costs of efforts (e.g., communicating with suppliers or paying more for modular sizes) to implement modular sizes. Investment opportunities with a quicker payback would be preferred. This behavioral phenomenon can be viewed as a type of "social trap."[21] The short-run reinforcers from modular packaging to a distributor lead to behavior which does not yield desired longer-term consequences.

E. Incentives for Distributors to Vertically Integrate to Modularize Private Label Products

In Section 8.2.6 the analysis indicated that market contracts between a distributor and a private label supplier for products in modular package sizes would be difficult to establish. In short, increased interdependence resulting from the transaction-specific investments needed to produce modular size call for an assurance of a continued transactions. However, bounded rationality and opportunism prevent contracts from being completely specified.[22] It was argued that bringing the transaction within the firm (i.e., vertical integration) would reduce opportunism and thus make it workable.

The existence of a threshold number of products which would need to be changed to modular sizes in order to produce savings to a distributor is one factor affecting the incentives to vertically integrate. Currently, the proportion of self-manufactured goods out of total sales of distributors integrated into manufacturing is relatively low. For example, the largest eight chains manufactured about 9 percent of their store sales in 1977. Generally, retail integration has been focused in areas of low levels of advertising such as dairy and bakery products.[23] Little is known about the number of items in modular containers necessary for a distributor to realize savings. One would suspect that it is much greater than the 9 percent manufacturered by some of the largest chains. Thus retailers would probably have to integrate into a significantly greater number of products to achieve any savings in their distribution operations from modularization. Also, they would have to integrate into the manufacturing of a broader spectrum of products than they currently do. This prospect makes it unlikely that a distributor would manufacture

modular private label products for this purpose. Also, concerns about increasing private label prices relative to brands discussed in Section 8.2.6 would be a factor decreasing the likelihood of distributor vertical integration.

8.3.3 Barriers to Collective Action Through Industry Trade Associations

The discussion up to now has focused on barriers to vertical coordination through the market. It appears that modular packaging presents some substantial challenges to the market mechanism's coordinative abilities. An important question is: Why haven't distributors articulated their preferences collectively through their trade associations or government? Several potential barriers to collective action are addressed in this section.

A. Transaction Costs of Collective Action

Collective action is a form of voice and voice is a costly activity relative to exit. The collective articulation of voice is much more costly since it also involves: 1) getting people together to communicate; and 2) the formulation of a uniform preference or concensus for the group. The costs of the first step would be substantial because of the high number of distributors. Government antitrust policy adds to the transaction costs since the process of standard setting must be pluralistic and open in order to reduce the risk of antitrust prosecution. The added legal fees increase these meeting costs.

The transaction costs of the second step of preference formulation depends upon the size of the group and its heterogeneity. If the group is relatively homogeneous, the time and effort needed to reach a concensus

would be minimal. However, tremendous diversity of distributors and manufacturers exists suggesting that the costs of agreement are quite high. The differing awareness and interpretations of modularization also imply that considerable effort will be necessary to achieve common understanding for effective communication. In sum, the transaction costs of collective action based on the factors identified above would appear to be quite high.

B. Possible Skewed Horizontal Distribution of Benefits to Distributors

Another possible reason why collective action has not occurred is that some segments within a horizontal level of the distribution industry may perceive that the benefits of the proposed innovation are skewed toward a particular subgroup of the participants. For example, the benefits of the industry-wide effort to implement the UPC symbol are being enjoyed by only a small proportion (4.3 percent) of all grocery stores and almost one-third of supermarkets (annual sales greater than $2 million).[24] Modularization may be similarly perceived by some distributors. For example in Section 7.1.2-B, it was suggested that modularization would be most beneficial to mechanized distributors. Thus, if operators of manual warehouses, which account for 90 percent of the annual case flow, perceive modularization as providing concentrated benefits to a group that already is on the "cutting edge," they will be unlikely to support a collective trade association effort. Again, distributor heterogeneity surfaces as an impediment to collective preference articulation.

C. Cost Incidence in the Manufacturing Sector

Implementing modular packaging could impose relatively higher costs on some manufacturing firms than others. Smaller manufacturers may be adversely affected for several reasons. First, smaller firms have less capacity to withstand conversion costs. These firms generally have less market power and thus have less ability to pass conversion costs forward. Second, eliminating of odd-sized packages and case packs, which are frequently produced by small manufacturers, would force these firms to compete with larger manufacturers. Modularization could impose greater costs on several other manufacturing segments. For example, manufacturers of light products (e.g., paper products and cereals) which tend to overhang pallets would incur greater costs in conforming to the 48 by 40 inch pallet than other firms. Also, manufacturers using bags for packaging their products would incur relatively higher costs if they were required to change to corrugated shipping containers.

If firms in some manufacturing segments believe that they will bear a disproportionate amount of the costs of modularization, they will be less likely to support collective efforts to implement this innovation.

D. Concerns About Government Regulation

While only mentioned by a few interviewees (who were very familiar with modularization), the concern about government regulatory activity concerning package size may be a factor inhibiting trade association action. In addition to statements expressing this fear, this observation is based on the two interview findings. First, a view expressed that the only feasible way to implement standard packages would be through government fiat. Several individuals believed that voluntary standards

would be difficult to implement in this area. Second, trade leaders interviewed indicated that the only role that they could legally assume was that of research and education, not implementation. Enforcing standards was beyond their jurisdiction. A situation could arise where research could show substantial benefits from modular packaging, yet firms would not voluntarily adopt the containers. Thus, a rationale may exist for government action to implement the innovation, which is an undesirable proposition from the standpoint of most managers and industry leaders.

E. Historical Factors

Modularization is not a new idea. As discussed in Chapter 4, U.S. food industry researchers and leaders became aware of the modular concept's application in Western Europe and brought this to the industry's attention in the late 1960's and early 1970's. Interest in the concept culminated with the retail chain trade association (NAFC) sponsored study by A.D. Little, Inc. in 1973-1974. The study's recommendations were not implemented. Reasons offered for the failed implementation of modularization reported by interviewees included: 1) the lack of manufacturer sponsorship and close participation in the study; 2) adversarial relationships in general and specific concerns about collusive distributor behavior illegal under the antitrust laws; 3) the academic nature of study (e.g., no close working relationship developed needed for implementation); 4) the study's lack of definitive conclusions and recommendations; 5) resistance to changing the standard grocery pallet base to a larger size (a modular system based on 54 by 45 inch pallet was found to have greater benefits); 6) lack of a leadership personality to bring the idea to fruition; 7) higher priorities given to other trade association objectives

(e.g., UPC joint industry project, merger of NAFC and SMI into FMI); and 8) a reduction in government interest in metrication. The problem of shipping container proliferation emerged as a problem, interest was sparked in modular packaging, it reached its pinnacle and then faded. The rise and decline of the modular idea is analgous to a life cycle model in which new ideas come into good currency and old ones are driven out.[25]

Different views have been espoused about why the modular idea fell out of good currency before it could be acted upon. The purpose of this discussion is not to sort out what was the most important reason for modularization's failed implementation a decade ago. Rather, the important point is that the historical context of modularization has coloured participants' image of the concept, its effects and workability. In general, distributors familiar with the history of modularization were less optimistic about the chance of its implementation than those unfamiliar. Those familiar with the concept tended to be more willing to work on smaller improvements (e.g., pallet overhang) rather than an "ultimate" modular program. One distribution manager for a retail chain company emphasized the importance of getting <u>something</u> done now (i.e., in the current trade association project) because of "burn-out" in those managers who have worked on this issue. This individual indicated that if nothing is achieved, then they will give up and it will be up to the next generation of managers to try.

8.4 Implications of Key Forces Driving Food Industry Change

In this section several key forces influencing industry change identified in the interviews are presented. The probable implications of these forces on modular package implementation are assessed.

8.4.1 Technological Forces

Technology is a key force shaping the evolving food system. Developments in the areas of information and physical distribution technology are likely to impact modular package implementation.

A. Information Technologies

The advent of scanning at the retail level made possible by the implementation of UPC symbols coupled with the availability of low cost computer power have brought about large-scale advances in distributor information handling, management and analysis. This greater sophistication has several implications for modular package adoption.

1. Impact on the Manufacturer-Distributor Power Balance. Food distributors are confronted with a daily barrage of decisions about buying, merchandising and pricing products. In the past, the decision-making load was eased by employing simple rules of thumb and relying on manufacturers' recommendations. The expanded use of computers and UPC scanning is dramatically altering these decisions. Distributors can now monitor individual product sales and they are increasing their knowledge of consumer preferences. Also, they are developing scientific management tools to assist decision making thereby reducing the need to rely on suppliers' recommendations.[26] This development along with increasing distributor consolidation and the success of private label and generic

items appears to be shifting the balance of power toward distributors.[27,28] Some analyses have emphasized the importance of UPC scanning in this evolving relationship and have suggested that power is correlated with the possession of information in the marketing channel.[29]

The shift in power is increasing distributors' abilities to influence suppliers to make changes which would lower their costs. Some of these changes could be made in the area of packaging. Several retail firms are requesting revisions in product packaging and in some cases are discontinuing or refusing to accept certain package designs and types.[30] Continuation of these trends could further enhance distributors' abilities to influence suppliers to make package design changes, possibly including modularization, to lower their costs. One final point is worth noting. The existance of a dominant retail sector (such as in Switzerland where modularization has been implemented) has been identified as the most favorable condition for modularization to occur.[31] Thus, based on other countries' experience, it appears that the evolving power relationship will probably increase the potential for modularization in the U.S.

2. The Impact of Distributor Information System Advances On Incentives for Modular Package Adoption. UPC scanning and low-cost computer power are permitting the development of information systems capable of monitoring individual products' performance. In addition to studying product movement, some firms are beginning to monitor the costs of handling products on an individual basis. The probable implications of two recent developments are described below.

Large supermarket chains in numerous regions of the country have implemented spoils programs. Manufacturers' products which are damaged

during distribution and unsaleable at the retail level are collected by a distributor at a central location. Here products are scanned, sorted by manufacturer, and reports detailing aggregate damage and incidence by manufacturer are prepared.[32] Return invoices are sent and manufacturers are requested to pick up and purchase back their products. The spoil programs have at least three implications for packaging. First, the precise accounting of the aggregate amount and cost of damage has increased distributors' awareness of damage and its causes. Major questions have been raised concerning who is at fault for damage and who should bear its costs.

Second, according to interviewees, the premise of a spoils program is that the manufacturer is responsible for all damage occurring in the food distribution system. Thus, manufacturers are expected to buy back their damaged items. This effectively shifts the cost of damage back to manufacturers. This may, as some proponents of the programs have argued, create incentives for manufacturers to undertake improvements in packaging. While the programs clearly send a signal to suppliers, this information may be incomplete. The amount and cost of damage to products may indicate that a problem exists, but information is needed on where and how the damage occurred in order to change packaging to correct the problem.

Third, the precise accounting of damage allows retailers to determine the incidence of damage among different manufacturers' brands and sizes. The true cost of carrying products is being discovered. To the extent that such information is utilized in buying, merchandising and pricing decisions, an incentive will exist for suppliers to undertake package improvements. Whether manufacturers make these changes will depend upon the ability of the market mechanism to transmit information back through the channel. One might presume that incorporating damage

cost into a product's price would be an adequate incentive to a supplier to improve packaging. However, the market's functioning can be restricted in several ways. The increment added to product price could be so small on a per product basis that consumers may not perceive the increase and sales would be unaffected. Even if consumers are sensitive to minute price differences, the resultant market-generated information may be incomplete. A decline in sales may not provide a supplier with specific information about what aspect of the product needs to be changed to regain lost sales.

The use of information on damage incidence of various manufacturers products in procurement and merchandising decisions may be a more effective way to create incentives for better packaging. For example, if a large distributor uses damage cost as a criterion in selecting products, the sales of a supplier using poor packaging would be immediately affected. This supplier would then have an incentive to improve its packaging.

Also, a distributor that utilized damage cost as a criterion in allocating supermarket shelf-space would affect the exposure of a product to consumers and thus their sales. Consequently, a supplier having inadequate packaging would be penalized by receiving poorer shelf location.

A second application of information systems developments is that of individual or Direct Product Cost (DPC) analysis. A number of leading distributors are developing and using computer models which account for cost factors, including handling characteristics of secondary and primary packaging, in order to get a better picture of an item's true profitability.[33,34]

The widespread application of DPC and the use of the data generated in distributor procurement and merchandising decisions will likely have profound impacts on manufacturers' incentives to make packaging changes. The use of DPC amounts to a discovery of "impacted information" needed to coordinate the various functions and stages in the food marketing channel. The discovery itself will not lead to better coordination. However, the use of this information in decisions can serve to improve coordination. The most clear-cut way this can be illustrated is through basing prices on individual costs. If DPC is used in this manner, it amounts to applying the market mechanism by correcting a situation where prices deviated from their marginal costs. This should improve the synchronization of the vertical marketing stages through more accurate price signals. Barring the problems previously mentioned (i.e. consumers' inability to perceive minute price changes, incomplete information in price), pricing based on DPC should create incentives for manufacturers to undertake package improvements since they will be rewarded directly by having cost savings accruing in distributors' operations reflected in lower prices for their products. Making the market work in this manner is akin to what Lerner has called "privatizing" public goods or establishing the institutions (e.g., pricing practices) "by which the individual or group who pays for the benefit gets it and the one who does not pay for it does not get it.[35] In cases where costs are averaged into price, any supplier making a package improvement reduces all suppliers' product prices by a minute amount. Under DPC, the supplier making such a change exclusively benefits by having its price reduced by the full amount of the savings. This reward represents an incentive for manufacturers to undertake shipping package improvements.

The above illustration focused on using DPC in pricing products. DPC data could be used as a criterion in procurement and merchandising decisions to improve vertical coordination and provide incentives for the adoption of package improvements.

Widespread use of DPC data in distributor decision making should create supplier incentives to make package improvements of a certain type. That is, it would probably encourage suppliers to undertake package changes which, by their action alone, can provide savings to distributors. Examples include: 1) strengthening the quality of corrugated material to reduce damage; and 2) shrinking case size (cube) to conserve storage and transport space. Procter and Gamble has already redesigned several of its retail and shipping packages and is working with distributors to demonstrate savings of such changes through DPC analysis. It is also widely publicizing these efforts in the trade press [see Exhibit 8.1].

While DPC is likely to encourage adoption of package changes of the type described above, it is unlikely to provide incentives for system-wide improvements such as modularization. DPC is a force which allows greater synchronozation of vertical system stages, but implementing a major system-wide change involves disruptive forces of the adaptation process of vertical coordination. Three reasons exist for DPC analyses' inability to create incentives for modularization. First, and most obvious, is that a modular packaging system is unlikely to develop on its own through market processes without collective decisions about the ground rules (e.g., how it would be operationalized) being made.

Second,there are difficulties in getting a modular package program started. Since a "critical mass" of products in modular containers is needed to produce an effect, no one supplier making the change can reduce

"P&G's new Crisco Oil case saves us 24¢. Amazing!"

Jim Moody, President & Chief Executive Officer, Hannaford Bros. Co.

"It's never too late to learn new and better ways to do business. That's what I told the people from P&G awhile back. They listened very carefully. And now they've started doing specific things to help us cut our costs.

"Now, I'm listening to them and I like what I hear. With scanners and computers and hard work, we've worked with P&G to discover new ways to measure the true costs of handling products. So now we can know which products and sizes are profitable and which aren't. And by exactly how much.

"Our people tell me we can handle the new Crisco Oil cases for considerably less than the old ones. How? For one thing, the bottles are plastic and they weigh one-third less than glass. Their case cube is smaller. And the sizes—24 and 38 oz.—were replaced by a single, narrower 32 oz. size. It all adds up to 24¢ per case lower operating expenses for Hannaford.

"P&G, I'm glad you are listening to our needs and working with us to find better ways to do business together. Keep it up!"

Procter & Gamble

Exhibit 8.1 Manufacturer Advertisement Citing Benefits of Package Change Calculated Through Direct Product Cost Analysis

distributors' handling costs. DPC analysis would find no advantage for a manufacturers' product in a modular case until the critical threshold point was reached. Consequently, no incentive exists for one manufacturer to take the lead in implementing modularization since it cannot capture the benefits of such action. Thus far, discussion has focused on difficulties in starting up a modular system. If some way would be devised to achieve sufficient adoption to reach the threshold point, then DPC would reward those undertaking the change. The cost and price advantage conferred to suppliers' products in modular sizes would induce the remaining firms to follow. The heart of the problem is to achieve widespread adoption which the market, even when vertically coordinated by DPC in a synchronization sense, does not appear capable of.

A third problem could arise due to the widespread horizontal effort needed to produce benefits. The end result of coordinated efforts by many suppliers to implement modularization will be a lower level of handling cost in the distribution sector and probably reduced prices for all products. Consequently, there is little opportunity for any one supplier to gain a significant advantage over any other.

The use of DPC could affect shipping container sizes in a different way. For example, the analysis of product movement and cost at the retail level may find that case packs should be changed to increase profits. Distributors may begin requesting new case packs thereby exacerbating the container size proliferation problem at the warehouse. Given the heterogeneity of distributors, diverse demands for case pack changes would be expected. Meeting all these different requests would be extremely expensive for a supplier. The threat of a higher cost destandardized system may cause manufacturers to urge distributors to agree on a more common

approach to case packs. Thus, the end result could be pressures for case pack standardization which, if done with distribution concerns in mind, could contribute to the development of a modular packaging system.

3. Productivity Improvements Possible Through Information Technology As a Substitute for Modularization. The possibility exists that further developments in computer and information technology will continue to provide substantial opportunities in productivity enhancement and cost reduction.[36] If this happens, opportunities to improve productivity via innovations (such as modularization) which enhance productivity in physical distribution may be overlooked.

B. Physical Distribution Technologies

Developments in the area of physical distribution (primarily warehousing) technology could have both a positive and negative impact on modular package adoption. One view is that new technology will allow warehouse productivity advances without having to reduce the number of container sizes. For instance, automatic load assembly of cases into pallets may be possible with robots having the ability to sense and adjust to the various sizes. Apparently the bottleneck is that a program has not been designed yet capable of instructing the robot. Possible future advances in computer science may overcome the problem thereby eliminating the need to standardize cases to achieve automated load assembly. Also, new technology could very likely be developed allowing further warehouse automation and mechanization despite the proliferation of package sizes.[37] However, modularization benefits in other areas (e.g., damage reduction or space use) would not be achieved.

A contrasting view is that application of new technology for warehouse automation will increase but large-scale advances will depend upon some degree of standardization of shipping containers. Proponents of this view see the increasingly successful application of mechanized (pick-to-belt) systems by distributors as a force which will drive shipping container standardization. As more distributors implement this technology, there is an increasing likelihood that manufacturers will respond and change their practices. A distribution executive for a leading supplier indicated that its company's rule of thumb was that it did not commit to a major change until 50 percent of the distributor trade expressed a need for it. If other manufacturers share similar operating practices, the continued growth of mechanized distributor warehouse system could drive manufacturer adoption of standardized shipping packages.

8.4.2 Changing Legal Factors

A. Trucking Regulations

A reduction of government regulation has eliminated some legal restraints which formerly prevented companies from efficiently using their distribution resources. For example, since the Motor Carrier Act of 1980 was enacted, distributors have been able to receive discounts by using their empty trucks returning from retail deliveries to pick up purchases from manufacturers. Through expanded backhaul of suppliers' products top managers and key decision makers (buyers) in distributor firms are recognizing potential profit opportunities through the distribution function. One implication of the increased awareness of the distribution function is that package standardization, which would lower distribution costs, will probably receive greater attention from firm managers.

A second regulatory factor which may affect modularization is the change in rules specifying maximum truck weights. The benefits of increased utilization of transport space are constrained by these weight limits. Even if space is better utilized by modular packages, weight restrictions may prevent the truck from being loaded to its cubic capacity. The Surface Transportation Assistance Act of 1982 raised these limits. This effectively increased the potential transportation savings from modularization possibly making the innovation a more attractive alternative to managers to reduce costs and increase profits.

B. General Government Policy Concerning Business

The Reagan administration's very pro-business attitude has at least two important implications for modularization. First, the slackening of antitrust enforcement relative to the 1970's has probably reduced fears of antitrust prosecution which might result from collective efforts to discuss and/or implement standards. Thus a barrier, or perceived barrier, to modularization has been lowered potentially increasing the probability of implementation. However, the risk of suits by private parties that perceive they would be injured by any standards that are agreed upon remains a concern.

Second, the pro-business attitude has probably eliminated the concern that government could take regulatory action to standardize packages. The effect on modular package implementation could go either way. On the one hand, any distributor leaders that were held back from pursuing modularization by a fear of government action are more likely to aggressively work toward implementation. On the other hand, the removal of the threat to set standards by legislation could eliminate the stimulus

needed for industry to address the topic. Which effect has been or will be more important is hard to say.

8.2.3 Economic Trends

A. General Economic Conditions

The general economic conditions have an impact on industry participants' interest in exploring and adopting innovations that reduce costs. The role of inflation and interest rates are briefly explored here. In inflationary periods such as late 1970's, distributor firms were able to easily pass cost increases forward. Several managers interviewed indicated that the reduced inflation rates of the last several years had made it more difficult to pass on increased costs and greater attention was being placed upon improving productivity to lower costs and thus improve profit margins. If price increases continue to moderate, the emphasis on productivity-improving innovations could expand. Consequently, modularization may be given greater attention.

Interest rates affect the potential for modularization. First, the high rates of the last five years have decreased distributors' willingness to tie up money in large projects (warehouse automation) that would probably benefit most from modular packaging. Instead, firms have implemented engineered labor standards and incentive programs which increase productivity with almost no investment (high return on investment). Several distributor respondents believed that this was a very short-run approach to productivity improvement since human limits would soon be reached. Instead they emphasized that the key to long-run productivity advance was greater automation.

High interest rates also affect how decision makers allocate resources to various projects. Several managers expressed concern that the return on investment or "bang for the buck" from efforts to implement modularization did not compare favorably. One respondent emphasized that longer term, somewhat uncertain nature of modularization benefits made it unattractive compared to internal innovations available to the firm. In sum, it appears that high interest rates influence distributors to focus upon short-run innovations with quicker payback periods than modularization or the complementary good of automated warehouses.

B. Costs of Distribution Resources

Over the last dozen years, the cost of key inputs to the physical distribution function have expanded. Labor costs in food distribution increased 8.4 percent per year from 1973 to 1983.[38] In this period, rising world oil prices pushed fuel prices upward. The higher prices for these two key inputs has resulted in increased expenditures on physical distribution. As a consequence, it has taken on a more visible and important role in many firms' organizational structures. In addition, the level of education and sophistication of managers is increasing. These changes should lead to greater attention being paid to the measurement of distribution productivity, investigation of factors affecting productivity, and the exploration of alternatives (such as modularization) capable of enhancing productivity.

The phenomenon of rising input costs and the increasing importance assigned to distribution occurred primarily over the 1973 to 1982 changes period. Over the past two years, labor and energy price increases have

moderated. Thus we may be seeing a slowing of the process described but are very unlikely to see its reversal.

C. Changing Demographic Factors

The slowing of population growth, changing age structure and family unit size, and new lifestyles are all factors which have altered food consumption preferences.[39] Manufacturers and distributors have responded to these changes by studying consumer demographics and developing marketing strategies based on segmentation. For example, retailers have responded with market segmentation by varying store formats and diversifying their products and services. Manufacturers have responded by increasing their advertising and new product introductions.[40] Firm responses to changing consumer demographics are leading to a more diverse food system at every level from package sizes to the retail store. M. Wright, the top executive of the nation's largest wholesaler, Super Valu, predicted the following:

> We believe stores will reflect a new "ADI"--their area of demographic influence. The most visible effect may be store-format alternatives. However, within these formats, there will also be more merchandise alternatives, giving rise to specialized suppliers, a need for wider variety requirements at point of distribution/warehouse. Successful merchandising will be done on a store-by-store basis.[41]

Thus, demographic changes are driving the food system from the efficiencies of standardization. If these forces continue to be important and, they likely will, standardization of secondary packaging will be difficult.

While the general thrust of demographic changes is leading toward greater diversity, several specific developments may increase the potential for implementing modular containers. First, changing lifestyles

have resulted in a greater proportion of food being consumed away from the home. From 1978 to 1983, away-from-home food expenditures increased 65 percent.[42] As more manufacturered foods are distributed through the food service channel, the importance of package size in product promotion and differentiation at the supermarket shelf level may be reduced. If this occurs, manufacturers resistance to any retail package modifications needed to modularize shipping containers would be reduced.

A second result of demographic changes occurring that could reduce manufacturers resistance to modularization is electronic shopping. Some researchers predict that this type of food delivery system will be prevalent in the future.[43,44] The extent that this development reduces the role of the retail package in selling the product, marketing barriers to modularization will become less important.

8.4.4 Success of Cooperative Interindustry Projects

The success of several joint manufacturer-distributor projects to improve total system productivity is an important factor affecting industry relationships and the study and implementation of other innovations such as modular packaging. The most significant and successful joint effort was the implementation of the UPC symbol. The success of that project did three things which will affect other system-wide innovations requiring manufacturer-supplier cooperation. First, it established a model, a vehicle, for the study and implementation of complex and widespread change. Second, it increased awareness of the extreme interdependence of suppliers' and distributors' actions and the need for cooperative efforts to improve performance. Third, and most importantly, it demonstrated in concrete terms the benefits that could be had through

cooperation. The success of the UPC project has lead to greater appreciation of the value of a "systems approach" to improving food industry performance. In the last few years, many food industry leaders have endorsed a "systems approach" to improving food industry performance. For example, the chief executives in some of the largest U.S. food manufacturers have expressed their willingness to support inter-industry projects which would reduct total industry costs and thus consumer prices, even if it means higher costs for their firms.[45] Several jointly sponsored trade association studies aimed at improving total system productivity have been completed. As discussed in Chapter 4, the major trade associations representing manufacturers and distributors have jointly funded a study of shipping container design.

The joint industry study is a major development that may have important implications for secondary packaging and possibly for modularization. The degree to which modularization will be affected will depend upon the degree to which it is investigated in the project.

As has been noted in Chapter 4, a number of size standardization options, including a standardization program similar to modularization, were among the 29 opportunities to improve shipping container design investigated in the first phase of the study. A.T. Kearney, the consultant conducting the research, recommended the improvements of increasing bag strength and standard cases for similar retail packages for in-depth investigation in the project's second phase. Package standardization, which had the greatest savings potential and was classified as having the "best long-term potential" for improving productivity, was not selected for further study. However, the "partial modularization" step of

standardizing containers with similar retail packages will be further investigated. Kearney notes:

> Standardization of the shipping containers for products with the same retail pack would yield benefits similar to the modularization concept, reducing damage, and increasing load stability.[46]

The likelihood of implementing this option should be high since marketing resistance would be reduced or eliminated, due to the fact that retail packages would be unaffected. Also, only ten percent of dry grocery case volume would be impacted. If the standardization of container sizes with identical retail packages is accomplished, it could serve as an initial step toward achieving the more substantial savings of a standardized modular container system. However, such a partial approach will not likely reach the threshold level of standard sizes needed to yield the substantial savings of a complete modularization program. A benefit-cost analysis of this "partial modularization" step should not be viewed as indicative of the economic worthiness of a modular packaging system.

The joint industry study should remove an important informational and communication barrier to modular package adoption described in Section 8.1. Given participants' diverse interpretations of the modular concept, there is a clear need to define and clarify shipping container improvements and issues. The joint industry study's broad approach of identifying, classifying and analyzing opportunities to improve shipping container design should go a long way toward addressing this need. Since the entire spectrum of package improvements has been defined, the potential exists for a common understanding of the modular concept. More effective discussions of modularization should result thereby contributing to the implementation process.

8.5 Modular Container System Design Recommendations

One of the problems with modularization is the magnitude of the change it would involve. Consequently, it is difficult for a firm or even the industry to get their arms around. Therefore, it may be necessary to take smaller steps of "partial modularization" which might lead to implementation of a full modular program. Two recommendations of such partial steps which appear to have favorable benefit-cost ratios are described below.

8.5.1 Shipping Container Standardization Through Altering Case Pack or Configuration

The costs of modularization appear to be directly related to the degree to which retail packaging is affected. Also, manufacturers are concerned that a modular container system would limit retail package sizes and therefore constrain their marketing flexibility. Thus, if a partial modular system were developed which did not affect retail packaging, it would likely have low physical conversion costs and meet little resistance from a marketing standpoint. The only way to do this would be to standardize shipping container dimensions by altering the case count or configuration within a case.

The amount of shipping container standardization possible through varying case count or configuration is not precisely known. The A.T. Kearney study investigated the feasibility of standardizing shipping containers that have identical retail package sizes. They estimated that 1.4 billion cases, or about 10 percent of the dry grocery cases manufactured annually would be impacted.[48] The actual number of cases which could be standardized by changing count or configuration of primary

packages may be slightly greater since nonidentical retail sizes may also be standardized to the same shipping container size .

A key question is whether the amount of standardization possible through altering case counts will achieve the critical threshold level needed to produce savings to distributors. If Kearney's estimate of $14.2 million per year is correct, it appears that some savings could be achieved from this "partial standardization" step affecting only 10 percent of cases. On the other hand, there are reasons to expect that altering case counts or configurations would not produce substantial savings. For example, this option would probably have minimal effect on container height, the dimension which has been identified as being most critical for container stackability and warehouse automation. [See Section 8.5.2.] Also, marketing resistance to this change may not be completely eliminated. For example, manufacturers would resist redesigning containers in a way that reduced the count per case since it would increase the risk of out of stocks and possibly reduce shelf exposure. Conversely, unless a product is fast seller, distributors may resist increasing the case pack because of concerns that inventory costs concerns and the scarcity of shelf space.

8.5.2 A System of Standard Modular Container Heights

A second "partial" step to a complete program of modular packaging would be to standard container heights which were multiples of one another and a standard pallet height. This is an attractive alternative for several reasons.

First, the benefits to distributors from this system are likely to be significant, although not as great as that of a complete modular system.

The evidence comes from three sources. A.T. Kearney found standardized pallet height and standardized container height to have the third and fourth greatest savings potential, respectively. [See Table 5.2.] Both were classified as having the "best long term potential" out of the innovations studied. Also, a number of individuals with considerable experience in the food distribution field have made qualitative statements about the potential benefits, particularly for automation, of standard container heights. Two quotes taken from the literature are presented below.

> The most important dimension, however, is the case height. Currently, case height varies from 2 1/2 inches to 30 inches. If the number of varying case heights could be reduced and made to be multiples of each other, the palletization of mixed pallet loads in the food industry would be vastly improved.[48]

> If some standardization could be adopted toward reducing the number of different case heights, we could make significant inroads toward better stacking and product protection and could begin to explore opportunities for mechanized or automated palletizing techniques long enjoyed by product manufacturers.[49]

A third source of evidence about the benefit of standard container heights came from the interviews. Representatives of materials handling equipment suppliers to the food industry identified the height dimension as being the most critical of the three dimensions to increasing automation and mechanization potential and to enhancing container stackability in warehouses of all types.

A system of modular container heights would also be attractive because conversion costs may be lower than changing either of the other two dimensions. For at least some package types (e.g., cans), the physical costs of modifying retail package height is lower than for changing length or width.[50] Also, altering retail package length or width would often

mean adjusting package closures, a relatively complex package element. For example, bonus size packages are usually extended upward.

Since there probably would be little opportunity to adjust counts or configurations of primary packages within cases in order to standardize their height, retail packages would require modification. Marketing flexibility would be limited, but much less than for a complete modular system. Only one degree of freedom would be removed from the retail package designer. Also, if length and width were not substantially changed, the sensitive area of competition for scarce supermarket shelf space would not be significantly encroached upon.

In sum, a modular system of container heights would probably yield the most significant savings in physical distribution short of a full modular system. It also appears that costs, both physical and marketing, of this proposal are likely to be less than standardizing other dimensions. While further information is needed to quantify these impacts, it appears that modular container heights would probably have a favorable benefit-cost ratio. Consequently, this option should be considered as an important partial step to the implementation of a complete modular program.

8.6 Institutional Innovations to Accelerate Modular Package Adoption

Based on the analysis of obstacles to adoption of modularization, an attempt is made to design institutional innovations that would accelerate its adoption. Three institutional innovations are outlined below.

8.6.1 Use of Direct Product Cost Data Reflecting Modularization Savings in Distributor Decision Making

This institutional innovation attempts to change distributor decision making practices so that the more widespread, longer-run benefits of modular packaging are taken into account. This innovation would involve three steps: 1) operationalization of the modular concept into a series of sizes and quantification of the savings of this system; 2) development of comparative (DPC) factors for all existing container sizes; and 3) implementing DPC factors reflecting modularization savings in distributor decisions.

A. Operationalization and Quantification

The modular concept needs to be taken from a concept to a specific series of modular sizes. Once this is done, it would be possible to precisely calculate the savings for each warehouse type. In addition, the quantification of effects for benefit areas that are dependent on the number of and particular sizes chosen, such as automated load assembly and warehouse mechanization, should be facilitated. The objective would be to calculate the cost of distributing products as if they were all, or a substantial portion, were in modular containers.

B. Development of Comparative Cost Factors

Once the savings for a selected modular package system were known, the next step would be the development of cost factors for all existing container sizes. For example, a cost factor could be based on the degree to which a particular container deviated from a modular size. These cost factors could then be utilized in a DPC model which would calculate the individualized cost of handling an item.

The purpose of such a comparative cost model is to provide incentives to manufacturers to make changes in package sizes which lead toward a modular package system. As noted, a fundamental problem for creating incentives for modularization is that no one manufacturer can produce any benefit for a distributor until a threshold is reached. Thus, no supplier can capture the benefits of its efforts toward the development of a modular system. This institutional innovation is designed to circumvent this incentive problem. It does this by offering a reward of a reduced cost factor assigned to a modularized product in the DPC model. This lowered cost factor is really artificial since there is no benefit until the threshold is reached. However, the reduced cost factor represents the benefits which would accrue in the longer-run after the threshold is reached. In essence, the innovation attempts to reflect benefits which will accrue in the future from the contribution of a manufacturers' conversion into present costs (prices). Given a well-synchronized vertical market communication system, this innovation should provide incentives for the adoption of modular containers when the benefits (lower prices) are greater than conversion costs. In other terms, the institutional innovation brings the long-run consequences to bear on decisions about package size by altering the short-run reinforcers to manufacturers.

The DPC model is designed to overcome the threshold problem. The model offers artificial incentives to the first manufacturers making the change. However, once a sufficient proportion of suppliers convert to modular sizes to produce savings to distributors, the savings in the model would actually be realized. The achievement of these savings should give assurance to manufacturers that the system will be generally adopted and an accelerating or "snowballing" effect should occur.

This institutional innovation has several advantages and disadvantages. One plus is that it avoids the quantification of manufacturers benefits and costs. The diversity of their operations due to different product and package materials types would make this industry-wide calculation difficult. Rather the only quantification needed is at the distributor level where the basic operations performed are more similar. Also, previous benefit work, such as the A.D. Little study, could be built upon. The conversion decision would be up to the individual supplier who has the best knowledge of costs of the change. Some products may be worthwhile to change while others may not.

The innovation also has several disadvantages. While a reward is given for conversion, there is the possibility that the threshold may not be reached. Knowledge of the proportion of products needing to be modular to generate savings would reduce this problem. If a few "holdout" firms can prevent the remainder from generating savings to distributors, the innovation's chances for success will be reduced. Additional problems for implementation are addressed below.

C. Implementation of Direct Product Costing (DPC)

This institutional innovation would depend upon the widespread use of DPC by distributors. The generation of DPC data would not be enough. Some mechanism needs to be developed to ensure that this information is used by decision makers. For example, for buyers to use DPC as a criterion in their decisions, a reinforcement mechanism must be devised to assure its continued use. Possibly DPC could be utilized as the primary measure of buyer performance. Similar incentive structures need to be developed to encourage the use of DPC data by persons making merchandising

and pricing decisions. The point is that DPC information may be generated but its use depends upon the incentive structures firm decision makers face.

A second problem for DPC implementation concerns industry-wide adoption. A number of interviewees felt DPC was unlikely to be important because it was at odds with competitive factors which drove decision making, particularly in the area of pricing. For example, if one distributor priced a product higher because it incurred relatively higher costs than other products, it may lose sales to competitors still offering the product at a lower price. Respondents concluded that DPC pricing would only work if all distributors used it. Proponents of DPC cite the use of cost information in a variety of decisions, such as merchandising and procurement, not only pricing.

The use of DPC information in distributor decisions could improve vertical coordination and produce incentives for modular packaging if the cost factors discussed above are incorporated. The impact on sales should provide the necessary information and incentives to manufacturers. However, the information content of the economic signal would be increased if manufacturers were aware of the cost factors being applied to their products. Thus, a complementary practice would be to send a product cost profile of each manufacturer's product to them.

8.6.2 A System for Monitoring Modular Container Adoption

A modular packaging system could be operationalized, its net benefits documented, and trade association guidelines developed, yet the implementation of the system would be up to individual firms. In the event that the DPC system described above were not implemented to create

incentives for adoption, an implementation monitoring system could be developed to facilitate manufacturer adoption.

An implementation monitoring system would keep track of the degree of adoption of modular containers by individual manufacturers and the aggregate level of industry adoption. It would be established and supported by distributors through their trade associations. The primary function of this monitoring system would be to survey manufacturers' products and compile information through time about adoption. This information would then be disseminated on a regular basis to top executives and key decision makers in food manufacturing and distributing companies. Newsletters and broader advertisements in the trade press could be vehicles for conveying this information.

The monitoring program would promote the adoption of voluntary guidelines for modular containers in four ways. First, the favorable publicity given to firms that take the initiative to implement modular containers would serve as positive reinforcement needed to obtain the "willing participation"[51] of such firms. The monitoring system would be put in the context of using a "systems approach" to reduce total food costs. While food industry observers note a growing endorsement of such an approach, they have questioned when firms will act to implement it. For instance, E. Walzer, editor of Progressive Grocer stated: "It will be interesting to see how soon the total system concept moves out of the conversation stage."[52] Monitoring the adoption of a specific innovation would provide an opportunity for firms to be recognized for actually taking leadership action to reduce costs for the overall industry and the consumer.

Second, a monitoring system would increase the power of peer pressure to move firms toward the adoption of modular containers. If manufacturers begin to convert their packaging, the program increases the visibility of firms that are unwilling or slow to adopt. Thus, peer pressure may be a more effective mechanism to change individualistic behavior to yield results which are more consistent with the overall industry's welfare.

Third, distributors could use information on the adoption rates of various manufacturers as a criterion in their decision making. For example, buyers and merchandisers may consider the level of adoption of modular containers as a qualitative factor in their decisions. Also, the availability of such information about adoption rates should increase discussion about implementation among top executives and trade leaders.

Fourth, a monitoring system would keep focus on the modularization issue after research was completed. It would serve as a measuring stick to indicate the degree of progress being made. Also, it should work to sustain interest in accomplishing system-wide innovations that take a long time period to implement.

8.6.3 A Mechanism For Long Run Industry Planning

The final institutional innovation proposed, which is broader, is a permanent interindustry productivity board. The board's function would be to serve as a focal point for soliciting and generating ideas for improving total system productivity through cooperative supplier-distributor endeavors. Several industry leaders have suggested the need for a board of this type and the idea has been endorsed by many of the leading food trade associations.[53,54,55]

The interindustry board would have several key features. It would need to have enough independence from existing food industry firms and trade organizations and their sometimes conflicting interests to study topics from a broader perspective. At the same time, close linkages with industry organizations are needed in order for it to be attuned to new issues as they arise and to have close working relationships established for implementing change.

Second, the board would be permanent. This would permit it to adopt a longer run view to identifying and prioritizing problems and solutions. A longer term research plan could be formulated that attempted to organize and integrate smaller projects (e.g., coupon handling, modularization) into a larger scheme of productivity innovation.

This broader view may enable manufacturers and distributors to cooperate on projects that they were heretofore unwilling to work on. Manufacturers might agree to work on a topic which involves costs for them and benefits to distributors in return for distributors' cooperation on projects having a reversed benefit-cost incidence. For example, industry observers have suggested that manufacturers would modularize shipping containers if distributors agreed to accept slipsheets on a widespread basis.[56] The permanent nature of the board would enable it to improve upon the pattern of past interindustry projects. Some industry observers have criticized past research as being conducted on an ad-hoc or piecemeal basis and for having a short-run emphasis.

Another advantage of a permanent board would be its ability to quickly start up projects as new problems and opportunities arise. This would reduce the lengthy start up process which has characterized some joint industry projects. Also, the availability of resources to study problems

would overcome the problem of overload on trade association leaders and firm managers cited by some interviewees. One distribution manager, who had worked on several interindustry committees, summed the problem up in the following way: "There is only so much time you can put into these things before they interfere with your job." In sum, a permanent board with adequate resources would provide the resources and continuity to start up projects quickly as the need arises and provide the ongoing support necessary for implementation.

A third important feature of this institutional innovation would be its ability to provide a focal point for discussion among industry and other participants on system-wide problems. The board could reduce the transaction costs participants face in discussing and reaching concensus on system-wide productivity issues. The board would sponsor conferences or symposia on its own or in conjunction with private or public organizations on specific topics. In addition, the board would attempt to foster the leadership needed for concensus-building and cooperative efforts to implement change. Trade leaders interviewed stated that a critical ingredient needed for larger interindustry projects to work was a project spokesman or a "quarterback" to orchestrate its various elements. Thus, the proposed board would attempt to cultivate leadership capabilities in individuals representing the board and in the industry.

The mechanics of initiating and continuing funding for a broad-based board that would product benefits that are diffused throughout the industry may be difficult. Seed monies would be needed to initiate the board's activities. These funds could be obtained from either the industry, private foundations or government. A rationale may exist for government to provide some funding due to: 1) the potential benefits of efficiency in

food distribution for publicly supplied infrastructure (e.g., highways); and 2) the savings in scarce resources (e.g., energy resources); and 3) potential reduction in consumer prices. The mechanism for continued funding of the board would involve the use of some of the fruits from successful joint industry projects to have a pool of resources on hand to undertake projects in new areas.

A major barrier to the establishment of a broad based interindustry board such as this is the fear of on the part of existing trade associations of losing their autonomy. Careful design of the representative rules to assure consideration of existing groups' interests could alleviate this problem.

CHAPTER 8

FOOTNOTES

[1]Bruce Marion, "Vertical Coordination and Exchange Arrangements: Concepts and Hypotheses," in Coordination and Exchange in Agricultural Subsectors, ed. by Bruce Marion, N.C. Project 117, Monograph No. 2 (1976), pp. 180-181.

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CHAPTER 9

IMPLICATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

In the previous chapter, integrative analysis of the study's findings led to identification of numerous communication and coordination problems in implementing modularization. Conclusions were drawn regarding the probable effects of important technological, legal and economic changes occuring in the U.S. food industry upon modular package adoption. Design recommendations for modular container systems and institutional innovations the industry could undertake to facilitate adoption were proposed. This chapter goes a step beyond Chapter 8 by drawing out implications for public policy specific to modularization and discussing the more general implications of the study's findings for productivity innovation in the U.S. food system.

9.1 Improving Food System Performance Through Modular Packaging: Policy Implications and Needed Research

The available evidence from both primary and secondary data sources indicates that modularization of shipping containers has a significant potential to improve performance of the food distribution system. However, this study found a wide array of factors acting as barriers to adoption of this system-wide innovation.

Food system participants' failure to adopt an innovation with considerable savings potential raises some important issues for public and private decision makers. Existing institutions appear incapable of generating incentives for food industry firms to adopt modular containers.

These institutional barriers suggest that modularization will not occur unless: 1) a participant is willing to assume a leadership role and place the interest of the total system and the consumer above its individual interest; or 2) the current institutions are adjusted to change the incentives to participants. With regard to the latter, several institutional innovations which the private sector could implement were described in Section 8.4. The focus of this section is upon institutional changes public decision makers could affect to foster modular container adoption. First, the available options are outlined Second, the elements of an appropriate public policy response are described. Finally, specific recommendations for further research on modularization are made.

9.1.1 Public Policy Options to Foster Modularization

The options available to public policymakers for accelerating modular package adoption can be viewed along a five-part continuum. Located in the first position on this continuum is increased research and development on modularization and the dissemination of the resultant information. Research could be initially focused upon the areas of modularization impacts that are most uncertain. Provision of more quantifiable estimates of benefits and costs to certain groups may provide the impetus for participants to act to implement this innovation.

Second, government could be proactive in implementing modular packaging by reducing barriers related to communication and collective decision making among and between the various industries. For example, government agencies conducting modularization research could sponsor or support in conjunction with private organizations conferences or

symposia on the modular concept and its implementation. The cost of collective transactions could also be reduced by having federal antitrust authorities further specify procedures to reduce the risk of public antitrust prosecution and, in particular, private suits. This would help to allay concerns about the risk of prosecution and should reduce the cost of collective transactions needed to discuss and agree upon standards having the purpose of improving productivity.

A third option is for government to use its power as an economic agent in the marketplace to create incentives for modularization. Government agencies or firms having government contracts could play a catalytic role in implementation if they only procured food in modular shipping containers. Establishing a stable demand for modular packages would provide assurance that the innovation will be generally adopted and therefore should induce interested firms to adopt the innovation.

Fourth, government could directly affect participants' incentives to adopt modular containers by changing tax policies or providing subsidies. For example, tax credits could be increased for investments made by manufacturers to change equipment to produce modular package sizes. Alternatively, subsidies could be utilized to compensate particular segments of the industry that were particularly disadvantaged by modularization in order to obtain their cooperation in implementing this innovation.

A final policy at the extreme end of the continuum is to change the property rights to determine shipping container size. These rights could be shifted from manufacturers to a government agency that would regulate container sizes or to another food system participant such as food distributors.

9.1.2 Elements of An Appropriate Public Policy Response

The type and extent of public policy response to the existence of an unexploited opportunity to improve food system performance should depend on present and likely future private sector initiatives. Several developments, particularly the increasing acceptance by major industry leaders of a "systems approach," will probably increase the potential for reducing food distribution costs through improved shipping container design. The study in the current joint industry project of a "partial standardization" option may indicate that private sector initiatives aimed at reducing total system costs may at some future point be extended to include a complete modular packaging system. Therefore, given no major change in present public policies, it is possible that continued private sector initiatives in this general area may very well result in the longer term to implementation of a complete modular container system.

The above conclusion, based largely on some positive recent developments, has implications for the appropriate public policy response. If private initiatives will eventually result in modularization, the relevant policy question is: How can changes be made to accelerate this process? Assuming that the trends noted above continue, the most appropriate policy options are the first positions on the continuum described in Section 9.1.1. The first option, increased research and development and the dissemination of results, is further discussed below. A final note should be made regarding this conclusion. If the trends noted slowed or reversed themselves, policy options further along the continuum should be of greater relevance to public decision makers concerned with improving food distribution system performance through modularization.

There are two additional reasons for focusing on the public policy option of increased research on modular shipping containers. First, a major study finding was that the lack of precise information on the effects of modularization was a barrier to its adoption. Research quantifying the effects of specific modular container systems would clearly contribute to the implementation process. Removing this information barrier is elevated in importance when viewed along with another key research finding. A major theme emerging from the research results was the inherently "system-wide" nature of modular container implementation problem. Many executives in food industry companies believe that one firm can do little individually to move the modular concept toward reality. Consequently, no manufacturing or distributing firm has been willing to take the lead in modularization. Clearly some firms have become large enough to significantly affect the implementation process. In particular, the trend toward greater consolidation in the food distribution industry and the informational advantages associated with scanning have increased distributors' bargaining power with manufacturers and therefore their ability to affect modular container adoption. While these firms may now have the capability to affect change, the factor which may be inhibiting significant action is the lack of precise knowledge of the benefits that would accrue to them. Therefore, government research which produced further information on modularization benefits and targeted dissemination at this group would probably accelerate the implementation process.

A second rationale for greater government research concerns the scope of private sector research efforts. There is presently a lack of information about modularization effects. Since the ongoing joint

industry shipping container study will not further investigate the effects of a full modularization program, this information void will continue to exist. By increasing research in this area, government could fill this void and significantly reduce or eliminate an important implementation barrier.

9.1.3 Recommendations for Further Research on Modularization

As noted, greater knowledge of modularization and its effects could be the critical ingredient needed to spur implementation. Four promising areas of research are proposed below.

A. Defining and Operationalizing the Modular Concept

Participants' diverse interpretations of the modular concept has contributed to communication problems which impede implementation of modular packaging. Some of these problems have been or will be solved by the joint industry study of shipping container design. By defining the entire spectrum of shipping container improvements, the potential exists for a common understanding of the modular concept and therefore for more informed discussion. However, the modular concept has not yet been put into operation in terms of the total number of specific sizes. While many participants hold beliefs about the nature and extent of the effects of the general term "modularization," the effects are very likely to differ depending on the specific modular sizes chosen and the implementation period. Thus, an important research need is to develop one or more specific systems of modular containers.

Operationalizing the modular concept would likely have several positive impacts upon implementation. First, it would allow discussion

to focus on specific alternatives thereby reducing the chance of miscommunication. Second, it would allow precise identification and measurement of impacts. For example, the degree to which retail packaging would be affected will not be known until the number of the specific sizes are chosen. Third, operationalization would take modularization from the category of "ideal" innovations to a concrete alternative. For example, a possible approach is to devise several alternative modular systems, each having a different total number of and specific sizes. Options for study would include practical "partial modularization" systems, which could be the first step toward the implementation of a full modular program. A system of modular container heights is described in the next section.

B. Identifying and Quantifying the Effects of Alternative Modular Packaging Systems

As noted above the exact nature and magnitude of impacts depend upon the specific modular system developed. Benefits and costs should be estimated and compared for each separate alternative that is operationalized. Thus, the general question of whether modularization is worthwhile (i.e., produces net benefits) should be refined into: 1) which specific alternatives have positive net benefits?; and 2) which alternatives produce the greatest net benefits?

One of the alternatives which should receive further indepth study is a system of modular container heights. The height dimension is critical to increasing the potential for further distributor warehouse automation and to increasing container stackability in warehouse operations. Also, conversion costs may be lower for this option. Research is needed to quantify the benefits and costs of this promising alternative.

The effects of each alternative modular system should be assessed for at least four levels: distributor warehousing and transportation, retailing, manufacturing, and the consumer. While currently the most is known about distributor level impacts, much additional work needs to be done. Benefits which have been identified (e.g., warehouse space use, worker training) need quantification. Categories of benefits which would not immediately occur but which would stem from the adoption of modular containers (e.g., warehouse automation, development of alternative distribution channels) should be further explored and quantified. Also, previous studies of modularization benefits require updating to account for technological changes and expanded knowledge of food losses.

A second recommended research area is at the retail store level. A number of potential benefits (e.g., cartridge shelf loading, modular display units, and reduced damage) have been identified by distributors but have not been quantitatively assessed. In light of the fact that about 75 percent of dry grocery handling costs have been found to occur at the retail level,[1] this area should receive careful attention. The benefits of the "partial" step of modularizing case heights to fit standardized store shelving systems at the retail level may be a fruitful area of study. The potential benefits of modular containers in various store formats have thus far only been speculated about and therefore deserve further investigation.

Third, the possible benefits and costs of modularization for manufacturing firms need to be identified and quantified. The diverse nature of the grocery manufacturing industry will make this a difficult task. However, it should be possible to identify common classes of effects and aggregate costs for the industry.

Conversion costs are aparticularly important area of study. Each alternative modular system would need to be evaluated for the degree of retail package impact. The technical relationships between retail packaging, case counts, and shipping containers must be understood before such costs can be accurately known. Conversion costs will be very sensitive to the period of implementation.

The effects of implementing each modular system upon consumers is a fourth level of impact worthy of further study. This effect would be correlated with the degree of retail package limitation. However, it is possible that a change in case pack could affect consumers through changing the amount of product displayed on supermarket shelves.

C. The Threshold Concept

This research hypothesized that modularization was one of a class of innovations for which a threshold level of adoption was needed to produce savings. Some limited evidence was found to support the hypothesis in the study. Few interviewees were aware of the threshold concept. The implications for economic incentives were drawn out and determined to be an important potential barrier to modularization. An important research need is to further document the threshold's existence and, more importantly, to determine its specific characteristics.

Knowledge of the level at which adoption of modular containers will actually yield savings is critical for several reasons. First, knowledge of the threshold is needed to place estimates of the benefits of modularization in context. The benefits of any "partial modularization" steps will depend upon the nature of this threshold. For example, Kearney has chosen standardization of shipping containers with the same retail

Package as one of two shipping container design improvements for in-depth study. A key question is whether this partial step of standardization affecting 10 percent of products would achieve similar benefits to modularization. Whether this or other piecemeal approaches can produce benefits similar to modularization depends upon the characteristics of this threshold. This consideration should be kept in mind when evaluating estimates of the benefits of "partial" modularization options.

Second, the threshold's characteristics should be specified in order to precisely calculate savings. If and when modularization is implemented, the change will take place gradually. To know the precise benefits of a specific implementation plan, it is necessary to know when benefits will begin to accrue. The time period in which the benefits accure will affect their value. Since food industry firms have a relatively short time horizon, benefits which are far out in time will be heavily discounted thereby affecting incentives for adoption.

D. Investigation of the Implications of Information System Advances

Information system advances were identified as a development with the potential to affect shipping container design improvements and possibly modularization. This development warrants considerable further study for several reasons. First, the extent to which the vertical coordination barriers (e.g., ineffective intrafirm communication) will be reduced is dependent on whether individual product costs information is used by distributors on a widespread basis. Numerous other package design improvements will probably not be made unless these vertical coordination barriers are removed. Second, direct product cost analyses' ability to create incentives for industry-wide innovations deserves further study.

This study suggested that such information alone may be insufficient to create incentives for change because of the existence of an adoption threshold. Further study of this problem and the potential of the institutional innovation proposed in Section 8.6.1 to deal with it is warranted.

9.2 Implications for Productivity Innovation and Food System Performance

This research project has focused on problems in implementing a specific system-wide innovation, modular packaging, in the U.S. food industry. Numerous factors were found to be acting as barriers to adoption of this productivity innovation. During the course of the study it became apparent that many of the impediments to modularization were also barriers to the adoption of other productivity innovations with the potential to improve food system performance. The implications of findings relating to participant characteristics and institutional coordination mechanisms for the general process of productivity innovation in the food system are discussed below.

9.2.1. Characteristics of Participants

A. Participants' Time Horizon

An important barrier to modularization identified in this study was the short-run planning framework of individual food industry firms. One reason offered for this short-run focus was the fast pace of activity in a competitive industry. Modular packaging was perceived by many individuals as an innovation that would take time to implement and therefore only yield benefits at a future period. Because of their relatively short planning horizon, firm managers tend to discount these

longer-term benefits and prefer to invest resources in projects having a faster payback. This participant characteristic is likely to be an obstacle to implementing other productivity innovations which produce benefits in the future. Participants' willingness to conduct research on productivity innovations needed to foster implementation is a case in point. Research is often not conducted on innovations that are fairly certain to yield large payoffs accruing primarily in the distant future. Alternative investments that are perceived to have a more immediate return on investment will be preferred. Participants' time horizon may be one factor impeding the needed research on automated and mechanized warehousing technology that is probably needed before large-scale productivity advances in food distribution will occur.

From a policy standpoint, the existence of a relatively short time horizon and the resultant failure to pursue innovations with longer-term productivity benefits suggests a need for collective action to seize these opportunities. Private collective efforts by trade associations may be sufficient to overcome this problem. However, to the extent that private initiatives fail to consider opportunities with significant long-term benefits, a role for government to study and encourage adoption of such innovations will exist.

B. Participants' Emphasis on Marketing and Merchandising Factors

An important characteristic of food industry firms is that they are very oriented to the marketing and merchandising aspects of their business. The interview results indicated that the subjugation of distribution productivity goals to marketing/merchandising goals was an important obstacle to implementing modular shipping containers. This

prioritization of goals, which pervades both manufacturing and distributing organizations, impedes not only the adoption of modular packaging but can prevent the adoption of other innovations that can improve productivity and lower costs. In general, as long as the key decision points in food industry firms are in marketing departments, there will be a greater likelihood for innovations capable of improving productivity elsewhere in the company (e.g., production lines, warehousing or transportation) to go unrecognized or to be discounted. Therefore, such innovations would not be adopted even though they have the potential to reduce total firm costs.

C. Participants' Reluctance to Change Practices

One barrier to intrafirm coordination needed to provide incentives for modularization identified in this study was participants' reluctance to change certain practices. In Section 8.2.4-B, the transaction costs of changing standard operating practices once they are established was suggested as a reason for firms' resistance to change practices. The strong inertia of traditional industry practices is likely to be an important barrier to implementing other productivity innovations in the food distribution system. In addition, there will likely be even stronger resistance to changing decision practices relating to marketing of products. One reason for this is the inherent nature of marketing decisions. A number of interviewees characterized marketing as "more of an art than a science." When a successful marketing practice had been developed there was great reluctance to change it. The potential loss of marketing flexibility through limiting retail package size and shape was an important barrier to modularization identified in this research. The

implementation of other existing and future productivity innovations which require changes in marketing practices will most likely also be impeded by similar resistance.

D. Individualism of Firms at Each Industry Level

A barrier to modularization identified in this study was the lack of a vertical "systems" perspective. Several primary and secondary sources indicated that the independent pursuit of goals by firms at each individual stage resulted in higher costs for the total vertical system. No individual firm takes into account the broader view of the entire vertical system and thus does not consider modularization to reduce total system costs. The individualistic nature of firms is also likely to surface as a barrier to other interindustry innovations capable of improving food system performance. In the next section, the ability of existing institutional mechanisms to coordinate individualistic firms' actions in the vertically aligned food manufacturing and distribution industries so as to result in improved performance of the system is discussed.

9.2.2 Institutional Mechanisms for Coordination

Several study findings relating to the ability of institutional coordination mechanisms in the food marketing system to create incentives for modular package adoption are also relevant to the implementation of other productivity innovations. Three specific findings are discussed below.

A. Distributor Procurement Practices

As elaborated upon in section 8.2.3-B, distributors' buying practices impede the transmission of the information and incentives

necessary for manufacturers to undertake shipping package improvements that would lower distributors' warehousing and transporting costs. This intrafirm coordination problem not only prevents the adoption of modular packaging but also diminishes the incentive for manufacturers to undertake any change in products that results in benefits in the distribution part of wholesale and retail firms. For example, a detergent manufacturer may develop a new product formulation that allows the volume of the package to be reduced. As a result, distributors benefit from reduced space requirements in their operations. Even though there are savings to distributors, buyers' would not consider these savings in their decision making. Therefore, manufacturers would have no incentive to implement such cost-saving improvements. In sum, distributors' procurement practices act as a general barrier to the implementation of interindustry produce and package innovations which could lower total system costs.

B. Distributor Cost Allocation Practices

The cost allocation practices of distributors were identified as an important barrier to effective operation of the food marketing system needed for coordination and the creation of incentives for the adoption of modular shipping containers. The lack of knowledge of the true costs of handling manufacturers' products acts not only as a barrier to modularization and other shipping package improvements, but also to other product changes which affect costs of handling a product in a distributor firm. For example, a manufacturer may make a change in retail packaging which facilitates handling in shelf-stocking at the retail store. However, since distributors do not accurately know the cost of handling individual products and then do not allocate such costs

to products, the resultant cost savings would not be factored into the product's price. Even though the innovation produced real savings to distributors, the manufacturers would not be rewarded. Consequently, manufacturer's incentives to undertake productivity innovations are severely weakened by distributors' cost allocation practices.

C. Organizational Slack

Some evidence was found in this study which suggested that competition in the food manufacturing and distribution industries is not intense enough to pressure firms to adopt modular containers to reduce their costs. In other terms, "X inefficiency" or organizational slack may exist. For example, many distribution firms indicated that the cost of shipping container inadequacies were simply accepted as a "cost of doing business." Since these increased costs can be somewhat easily passed to the next stage in the food distribution system, no great efforts to implement package improvements, such as modularization, that lower costs have been forthcoming. The lack of pressure to reduce costs resulting from imperfect competition may be an important factor inhibiting the adoption of productivity innovations in the food industry.

9.3 Observations About the General Process of System-Wide Productivity Innovation

It became apparent during the course of this study that the problem of implementing modular packaging has several elements which were common to the adoption of other system-wide productivity innovations. In this section, an attempt is made to describe some of the key characteristics of system-wide innovations. Several general categories of problems in implementing such innovations are outlined and observations

are made regarding key factors affecting the system-wide innovation process.

9.3.1 Characteristics of System-Wide Innovations

Three characteristics of system-wide productivity innovations are described below. Several innovations which fall into this general class are identified and suggested for further research.

A. The Need for System-Wide Coordination

Implementation of innovations of this type requires the coordinated efforts of many or most participants in the vertical marketing channel. In the modern interdependent food system, each participant has the capacity to greatly affect another. In many cases, uncoordinated independent decision making has resulted in higher costs for the overall system. There are also substantial benefits available through greater coordinaton among participants. Adoption of system-wide innovations which streamline the food delivery channel and result in smoother interface points between the various functional parts requires greater coordination of decision making both within and between firms and industries. Thus, an important characteristic of system-wide innovations is the need for formerly unrelated organizational entities to interact and better coordinate their decision making. Difficulties which arise in meeting the need for greater system-wide coordination are discussed in Section 9.3.2-A below.

B. Uniformity and Simplicity of the Innovation

Many innovations which have the potential to streamline the food marketing system and reduce overall costs have two attributes. First,

they require uniformity (i.e., standardization of the basic procedures, equipment or materials) in each of the vertically-aligned stages of the food distribution system. Such uniformity is necessary for the smooth and efficient interchange of information, money and physical goods between firms at each industry stage. The uniformity inherent in system-wide productivity innovations requires cooperation and agreement between various industry stages and among firms in each industry. Productivity advances involving mechanization can often only be achieved after broad intra- and interindustry agreement on a uniform system is made. The rate at which consensus is reached can determine the pace and nature of productivity innovation.[2]

Second, most system-wide innovations are modest devices[3] or, in other terms, are quite simple in concept. For example, the standardization of pallet sizes was a prerequisite for the efficient transfer of products between food manufacturers and distributors. Scanning at supermarket checkouts and, more recently, computer to computer communication between suppliers and distributors, were based on the development of a uniform electronic communication symbols and languages. Similarly, productivity in handling coupons has been found to depend upon the adoption of standard coupon formats and sizes. The concept of geometrically relating shipping container size to one another to form a modular system is a fairly simple idea. Several additional potential innovations which fall into this general class are discussed in Section D. While system-wide innovations may be simple in concept, the implementation process including obtaining agreement on the appropriate way to operationalize the general concept into a specific system can pose complex and difficult problems.

C. The Existence of an Adoption Threshold

As discussed in Section 8.3.2, the need to achieve a "critical mass" or threshold level of adoption of modular containers in order to yield benefits is an important implementation barrier. Since no individual manufacturer adopting this innovation can make a difference in a distributor's handling and shipping costs, there is little incentive for a manufacturer to change. Only if a significant number of firms change their packaging will benefits accrue to distributors. Individual manufacturers cannot capture benefits from modularizing their packages. Because a threshold exists, it appears that manufacturers only can produce distributor savings through coordinated adoption and therefore they can only capture the benefits of implementing modular packages collectively.

Several other industry-wide productivity innovations have also exhibited an adoption threshold. For example, application of the UPC symbol was needed on a substantial proportion of retail packages before it was possible for supermarkets to efficiently scan products and achieve productivity savings. Also, the benefits of a pallet exchange system are dependent upon a large number of manufacturers and distributors using a standard size and quality of pallet. Thus, the existence of an adoption threshold appears to be a common attribute of many system-wide innovations. The implications of this threshold for individual firm adoption incentives described for modularization above should be relevant for analyzing problems in implementing other system-wide innovations.

D. Possible System-Wide Innovations for Further Study

In the previous sections, three characteristics of modular packaging identified in this study were proposed to be relevant to the implementation

of a number of system-wide productivity innovations. This research has initiated the exploration of the implementation process forinnovations in this general class. The project could be followed up by additional studies which attempted to further understand the system-wide productivity innovation process. Attributes of such innovations could be further identified and additional implementation problems diagnosed. One possible way to increase understanding of these processes is to study system-wide innovations which are likely to have a great potential for increasing productivity. Several specific innovations in this general class which may be fruitful areas for further research are: 1) exchange systems or pools to facilitate shipping container and pallet return and reuse; 2) intermodal transportation systems; and 3) the adoption of a standard symbol for shipping containers to improve distribution productivity.

9.3.2 Implementing System-Wide Productivity Innovations: Generic Problems and Possible Solutions

Three categories of problems for the adoption of system-wide innovations are described in this section. Factors which appear to be important to overcoming each generic problem type are identified.

A. Selective Perception of an Innovation's Effects

Many innovations begin as an idea or notion in someone's mind about a new technological possibility. This new notion often initially exists in a general form before it is operationalized. For example, the basic idea of an automating supermarket checkouts through optical scanners and symbols on retail packages was conceived before specific systems were developed, operationalized and selected for use. Similarly,

standardizing and geometrically relating shipping container sizes to one another to form a modular packaging system was borrowed from Western European countries as a general notion that could improve productivity in the U.S. food industry. Only in the fresh produce industry has the concept been put into operation as a specific series of sizes.

The period of time an innovation remains a general notion appears to be an important factor affecting implementation. As a general concept, it is possible that participants may selectively perceive how it would be operationalized and what its impacts will be. System-wide innovations require cooperation among firms within and between industries. Given the heterogeneity of the food industry each firm has quite different perspectives and interests in an issue. When an innovation exists as a general notion, firms are likely to develop different perceptions of how the concept will be oprerationalized, who will receive benefits and incur costs and, therefore different perceptions of the concept's merit. The resulting divergent views of the innovation can lead to miscommunication and conflict among the parties whose cooperation is needed for implementation. Some firms in an industry may perceive that they will bear the brunt of the costs of change or that other firms will enjoy a disproportionate share of the benefits. Consequently, they will be less willing to support a collective effort to adopt the innovation.

Based on the barriers to modularization identified in this study and observations of the process of implementing other system-wide innovations, it appears that the length of time between an idea's conception and its operationalization is an important variable affecting the adoption process. Specifically, the longer an idea is at a general conceptual level, the greater chance participants have to formulate

different perceptions of how it will be operationalized and its effects. If an innovation is specified quickly, participants are likely to have more similar perceptions of benefits and costs and communication difficulties should be reduced. An innovation which is not quickly operationalized will have a greater chance of being selectively perceived leading to potential communication breakdowns and conflict. In addition, participants' views of the concept and its benefits may rigidify thereby inhibiting effective discussion and the consensus building needed for implementation. For example, it appears that modular packaging, while only at the conceptual stage, was cast as a proposal with no benefits to manufacturers. Early judgement of the concept's worth were made before a specific series of sizes were chosen and concrete information about that system obtained. It is very likely that a critical ingredient for successful implementation of an innovation is to operationalize it an early point before selective perceptions develop which inhibit discussion among the parties who must cooperate to adopt the change. Early provision of objective information on the effects of implementing a specific system should also facilitate the implementation process.

B. Problems in Formulating Collective Preferences for System-Wide Innovations

Several related factors influence the formulation of collective preferences for a system-wide innovation by firms in an industry. Firm heterogeneity appears to be one important variable affecting participants' ability to formulate preferences for an innovation and therefore to articulate these preferences. For example, in an industry made up of diverse firms, a manager may believe that problems (e.g.,

inadequate packaging) that they encounter are unique to that firm. Consequently, firms fail to recognize the similarities of their problems.

Information on the degree to which competing firms are experiencing similar problems is likely to be costly to obtain. Given this situation, a firm manager would perceive his/her firm's chances of resolving the problem as being extremely low. A supplier would charge a large amount for the manufacturing equipment changes needed to meet this special order of only one firm. However, if the problem were recognized on an industry-wide basis, a greater number of firms would request the change thereby lowering costs. Moreover, industry diversity tends to increase the likelihood that common problems will fail to be recognized and that industry-wide solutions will go unrecognized and therefore not be implemented.

Industry diversity can also act as a factor inhibiting the process of system-wide innovation once a common problem is recognized. As noted in the previous section, most innovations begin as a general notion of a solution to a particular problem. Firms may hold different interpretations of the solution and how it will be put into operation. For an innovation to be implemented, a common understanding of the concept and how it will be operationalized is needed. A consensus must be reached. The cost of achieving agreement will be greater in more diverse industries.

While industry heterogeneity can act as a barrier to the formulation of a uniform industry-wide preference for an innovation, in certain circumstances it can create a favorable environment for interindustry discussion of an system-wide problem. Such discussion can lead to formulation of a uniform preference for the innovation which is needed for implementation.

Two conditions appear to be necessary for heterogeneity to have a positive influence on system-wide productivity innovation. First, at least a few firms at the industry level where problems are experienced must be large enough to have some bargaining power with the adjacent industry level. Second, firms must demand their particular version of the solution to the problem (i.e., innovation) to be implemented. The adjacent industry receiving these requests then faces the proposition of having to supply several different types of systems which will be costly. Such firms most likely will be interested in development of a more rational uniform system to control their costs. For example, it appears that this interest has given a greater incentive to manufacturers to discuss industry-wide problems with distributors and to implement innovations from which they receive no direct benefit. The development of the UPC symbol in the U.S. and package improvements in Western Europe were two instances where diverse distributor demands have been identified as important in the implementation process.

C. Problems in the Articulation of Preferences for System-Wide Innovations

If well-defined and uniform preferences for a system-wide innovation exist in an industry, there are significant barriers to articulation of these preferences either through the market or collective institutional arrangements. Even though adoption of a system-wide innovation would improve the collective welfare of an industry or the food marketing system as a whole, individual firms have not made efforts to implement such innovations. In many cases, it appears that the pursuit of individual interests does not lead to an outcome which is consistent with preferred results for the collective entity. The existence of this behavioral

phenomenon where "micro" decisions result in undesirable "macro" outcomes in the implementation of modular packaging was discussed in Section 8.3.1.

Several factors identified in this research are useful in explaining the "micro-macro" problem in implementing system-wide productivity innovations. First, the need for a "critical mass" of adoption of a system-wide innovation before savings are produced prevents an early innovator from capturing the benefits of an innovation. Consequently, the economic incentive to a potential innovative firm is reduced. Only coordinated adoption by some critical proportion of firms in an industry will allow savings to be generated and captured by any firm. Therefore, an individual firm's incentive to adopt the innovation is weakened. If the food manufacturing and distribution industries continue to consolidate, there will be a greater chance that one or a few large firms' adoption of an innovation may be enough to produce benefits that can be captured by that firm.

A second important factor affecting the "micro-macro" problem is the nature of the benefits of a system-wide innovation. One firm's efforts to implement a system-wide innovation will benefit most or all firms in the industry. At least in large group situations, an individual firm will tend to not invest resources to the implementation of the innovation since it involves narrowly focused costs and widely diffused benefits. Theoretically, if the group size becomes small, it is more likely for individual firms to act to further a collective goal. The consolidation and resulting fewer firms in the food manufacturing and distributing industries should increase the probability that individual firms will act to further the group goal. Alternatively, the presence

of a leader which places the collective welfare of the group above its individual interest can act as a catalytic force in the system-wide productivity innovation process.

9.4 Overview

The industrialization process has transformed the industries involved in food production and delivery into a complex interrelated food system. The performance of this total system is dependent upon the coordination of interdependent activities in the food distribution chain. Numerous researchers and industry leaders have recognized that future substantial improvements in performance depend upon the adoption of innovations which better integrate the vertically-aligned stages to form a more efficient streamlined food system. A number of such system-wide innovations have been identified and studied. Many of these innovations have been found to have substantial productivity enhancement potential. However, as the analysis of modular packaging conducted here has demonstrated, numerous barriers to implementation of system-wide innovations exist. In its most elemental form, the implementation problem is that no firm has the ability to individually produce and capture benefits from adopting the innovation. Cooperation and coordination among diverse individual firms and industries is needed to yield benefits for the total system. Several factors can influence this coordination process and thus the pace of system-wide productivity innovation. First, participants' awareness of interdependencies and problems from a system-wide perspective is a prerequisite for firms to coordinate their actions. Second, institutional arrangements affect the articulation of collective preferences for a system-wide innovation. Finally, a concern for the

welfare of the collective entity rather than sole interest in individual welfare is a factor influencing a firm's willingness to work toward implementation. The emergence of firms with these leadership characteristics may be the single most important factor in the successful implementation of future system-wide productivity innovations.

CHAPTER 9

FOOTNOTES

[1]"Direct Product Profit Idea Gaining Ground," Supermarket News (May 14, 1984), pp. 1, 22.

[2]Martin L. Ernst, "The Mechanization of Commerce," Scientific American (September 1982), p. 133.

[3]Ibid.

APPENDICES

APPENDIX A

DOCUMENTS USED IN THE ACQUISITION OF DATA

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS
AGRICULTURE HALL

EAST LANSING · MICHIGAN · 48824-1039

Name
Address

Date

Dear Individual's Name:

I am a Ph.D. student at Michigan State University working on a study of the potential for reducing grocery distribution costs through industry-wide case modularization. The purpose of this letter and enclosed project summary is to inform you of the study and suggest a possible time to meet with someone from your firm to discuss certain of its aspects in more detail.

This study could provide quite useful to individual firms or the food industry as a whole. For instance, the results may shed light on ways to overcome barriers to standardization thereby paving the way for substantial warehouse, transportation, and possibly retail level cost savings.

For this research to succeed, we will need information and insights from individuals in many diverse organizations. Industry participation is vital. I would very much like to include firm name in a nationwide sample of type of firm firms that will be interviewed. I would be greatly interested in talking with individuals within your firm familiar with grocery procurement and distribution --operations likely to be most affected by case standardization.

I plan to be in the city or regional name on date, and I will suggest an time of day meeting with one or several of the above individuals as you deem appropriate. I'll call your office about a week before hand to confirm these arrangements.

In return for your help, I'll mail your firm a brief report summarizing the study's findings.

Sincerely,

Charles W. Abdalla
Research Assistant

Enclosure.

Exhibit A.1 Sample Interview Letter
and Research Project Summary

RESEARCH PROJECT SUMMARY

THE POTENTIAL FOR IMPROVING DRY GROCERY DISTRIBUTION SYSTEM PERFORMANCE THROUGH MODULAR PACKAGING

Investigator: Charles W. Abdalla
Address: Dept. of Agricultural Economics
Michigan State University
Agriculture Hall
East Lansing, MI 48824-1039
(517) 353-7894

Duration: September 1982
to September 1984

Problem Definition

Food distribution, a major component of escalating marketing costs, has recently been characterized by a low rate of productivity growth. One of food distribution's productivity problems is the proliferation of shipping container (case) sizes. A 1972 study by A. C. Nielsen found 2587 case sizes in a 5000 item grocery warehouse. Such variety affects distribution operations by forestalling the adoption of technological improvements dependent on case uniformity; causing inefficient transport and storage space utilization; and damaging and destroying food because of pallet overhang and unstable stacking. The resultant higher distribution costs have cut into food industry firms' profits and raised consumer prices and thereby initiated searches for ways to improve productivity and produce cost savings in the food distribution system. One proposal is to develop a modular container system predicated on fewer and standard case sizes. Despite expected benefits of enhanced productivity and cost savings, modular packaging has not been adopted in the U.S.

Objectives

To study factors influencing system-wide modularization of cases in the dry grocery segment of the food system. Specifically, the research will: 1) evaluate existing benefit and cost studies 2) describe key participants, organizations and institutions influencing modularization 3) analyze critical factors affecting modular packaging adoption and assess implications of changes in these factors upon food system performance.

Methods

The objectives will be accomplished via: 1) comprehensive literature reviews 2) interviews with potential affected parties such as package suppliers, food manufacturers, wholesalers and retailers. Information conveyed during interviews will be utilized in Ph.D. dissertation and subsequent reports with no attribution to firms and individuals interviewed.

Exhibit A.1 (Continued)

- BACKGROUND OF FIRM AND ITS OPERATIONS
- AWARENESS OF SHIPPING CONTAINER SIZE PROLIFERATION PROBLEMS
- AWARENESS AND UNDERSTANDING OF THE MODULAR CONCEPT
- THE PROBABLE EFFECTS OF MODULARIZATION
- THEMES OF INQUIRY:
  - HISTORY OF MODULARIZATION
  - TECHNOLOGY OF FOOD PACKAGING AND DISTRIBUTION
  - ECONOMIC FACTORS
  - MARKETING AND MERCHANDISING FACTORS
  - COMPETITIVE FACTORS
  - INTRAFIRM INFORMATION HANDLING
  - INTERFIRM INFORMATION HANDLING
  - RESEARCH
  - TRADE ASSOCIATIONS
  - GOVERNMENT
- NECESSARY CONDITIONS FOR MODULARIZATION TO OCCUR

Exhibit A.2 Guide to Interview Structure

APPENDIX B

JOINT INDUSTRY STUDY DOCUMENTS

REQUEST FOR PROPOSALS

FOR A STUDY TO

DEVELOP RECOMMENDATIONS TO IMPROVE PHYSICAL DISTRIBUTION EFFICIENCY IN THE GROCERY INDUSTRY THROUGH IMPROVEMENTS IN SHIPPING CONTAINER DESIGN

Exhibit B.1 Request for Proposals for Joint Industry Study of Shipping Container Design

BACKGROUND

The Food Marketing Institute (FMI) and the Grocery Manufacturers of America (GMA) and other interested associations plan to fund a feasibility study which would result in specific recommendations to improve the design of shipping containers.

A joint trade association task force will be formed to oversee --

> A feasibility study for improving physical distribution efficiency in the dry grocery industry through improvements in shipping container design, with full recognition of the total system impact from the manufacturer through the warehouse into the retail store.

Such a study is needed at this time because numerous developments are occurring in grocery distribution which have a direct impact on physical handling efficiencies in manufacturing plants, distribution centers, retail stores, and the transportation sector of the food system. Among these developments are:

1. Changing consumer demographics and buying habits

2. Increasing concern over product damage

3. Construction of mechanized warehouses and increasing study of robotics

4. Rapidly fluctuating fuel costs and related transportation investment costs, as well as recently approved 102-inch truck widths

5. Changing store formats and a rethinking of ways to open, handle, and display products

6. Increasing interest in direct product costing

7. Successful completion of project M.U.M. -- standardization of pallet sizes in the fresh fruit and vegetable industry

As a result of these developments, there is great danger that many individual changes in shipping container design will be made or requested without full consideration of the consequences to the total distribution system. It is time for a comprehensive look at this issue.

SCOPE OF WORK

A consulting firm to be contracted shall provide all necessary personnel, services and resources to accomplish the following:

1. Identify the significant barriers to improved physical distribution efficiency currently existing in the dry grocery industry as a result of shipping container design.

2. Recommend generic guidelines for shipping container design which could lead to greater total system efficiency while maintaining the flexibility necessary to permit the design of packages to meet the real or perceived needs of consumers. Consideration should be given to the marketing factors affecting the count of packages within shipping containers, the relationship of the number of packages within a case, and the flexibility needed to meet other marketing requirements.

   These guidelines may recommend changes in the physical characteristics of shipping containers and/or their sizes. In order to allow for marketing latitude, all recommendations regarding sizes should take the form of acceptable ranges rather than rigid size standardization.

3. Evaluate the technical and economic feasibility of the proposed changes including the impact on the manufacturing process, if that is affected.

All work is to be coordinated through a steering committee of industry representatives appointed by the sponsoring trade associations. A final report suitable for public distribution is to be prepared at the end of the project.

Because gains in efficiency associated with transporting and warehousing would be jointly beneficial to both manufacturers and distributors, the initial feasibility study should concentrate on these sectors of the distribution system. Within the warehousing and transportation sectors, some areas of critical interest are: container stacking density, load stability, conveyability, and durability. However, the total system impact of all proposed changes should be taken into consideration and care should be exercised that no recommendations improve transportation or warehousing at the expense of other functions, nor should package size, structure, or configuration be compromised versus consumer needs and usage requirements.

Once this initial feasibility study sets the priorities, at the discretion of the steering committee further studies are envisioned to develop specific implementation plans for selected design improvements.

TIMING

Responses are expected within eight weeks of the dissemination of the R.F.P. The project should be completed no more than 12 months after the contract is awarded.

A written proposal is to be submitted for initial screening with presentations to be made in person at mutually agreeable dates for those selected in the first round of review.

CONSULTANT QUALIFICATIONS

The consulting firm shall be readily recognized within the grocery industry as having the credentials necessary to perform this analysis. The proposal should include a summary of experience in this field.

The individual researchers involved should have demonstrable experience in the management of large interindustry projects. In addition, they should have the ability to make an effective presentation of their findings before industry audiences.

For those organizations invited to present their proposals in person to the steering committee, the individuals making the presentation should be those who would actually be conducting the feasibility study.

BUDGET

Because the scope of the study will vary with the project design, the fee schedule should be clearly presented with major elements of the work plan itemized separately.

Kearney

MANAGEMENT CONSULTANTS

A. T. KEARNEY, INC.
875 THIRD AVENUE
NEW YORK, NEW YORK 10022
212/751-7040

November 13, 1984

Mr. Leonard Lieberman
President and CEO
Supermarket General Corp.
301 Blair Road
Woodbridge, New Jersey 07095

Mr. Clifford Lynch
Vice President, Distribution
The Quaker Oats Company
345 Mechandise Mart Plaza
Chicago, Illinois 60654

Gentlemen:

We have prepared a brief executive summary outlining Phase I results of our study to Identify Opportunities in Shipping Container Design. The summary is organized into the following sections:

I - Background and Objectives

II - Scope

III - Method of Approach

IV - Findings

V - Conclusions and Recommendations

Many requests have been received from the industry and from trade media for information regarding the results of Phase I of the study. This executive summary may be helpful in responding to these requests for information.

We look forward to working with you on Phase II.

Respectfully submitted,

A.T. Kearney, Inc.

cc: Todd Mann
C. Edward Ashdown
Richard Brown
George Melnykovich

Exhibit B.2 Executive Summary of Phase I Results of Joint Industry Shipping Container Design Study

I - BACKGROUND AND OBJECTIVES

BACKGROUND AND OBJECTIVES

Over the past 15 to 20 years the grocery industry has cooperated on a number of projects designed to encourage standardization of various business functions and the manner in which different sectors of the industry interact with each other. These projects have included such programs as the 48" x 40" pallet, standard formats for purchase orders and invoices, universal product coding and procedures for computer-to-computer ordering. The purpose of these programs has been to increase productivity in the industry and reduce overall operating costs. They are generally recognized as having been highly successful.

About eight years ago the industry sponsored a study to determine the feasibility of improving and standardizing the design of shipping containers. It was felt at the time that such a study might lead to a reduction in the large number of different shipping containers in use and that this could lead to a meaningful improvement in distribution productivity. The distributor sector of FMI conducted an initial study to determine possible benefits. However, for a variety of reasons, no progress was made in actually implementing guidelines or standards.

In 1983, the boards of FMI, GMA, NAWGA, and NGA decided that the industry was again at a point where exploring the feasibility of standardizing shipping container design might be appropriate. This decision was based partly on the success of earlier industry programs and partly on the recognition that the shipping container is the "lowest common denominator", the single common element that flows through the entire grocery system from manufacturers and processors through distributors to retail stores.

The decision to undertake the study was prompted by the recognition that the grocery industry needs to respond to a number of marketing, operating and regulatory developments that directly affect distribution in the industry. In some cases these developments have increased costs for one or more sectors of the industry. In other cases, they have created opportunities which might only be fully exploited if the degree of standardization of the basic unit handled by the industry, the shipping container, is increased in some way.

The fact that the shipping container is the "lowest common denominator" means that any changes in design or attempts at standardization are likely to impact all sectors of the industry. At the same time, it is highly unlikely that the benefits and costs associated with change will be spread evenly among different industry sectors. In fact, it is probable that some sectors will

incur costs while other sectors will achieve benefits. This, of course, has the potential for creating conflicts among the different sectors.

The most effective way to prevent conflicts among industry participants is to build a broad industry concensus based upon a set of facts which are thoroughly researched and fully supported and to make special efforts to ensure that the interests and concerns of all participants receive careful and impartial consideration.

The way to build a lasting concensus is to develop it gradually, gaining agreement among interested parties regarding each set of facts, conclusions and implications at each state of the study effort. This "stepwise" concensus building process eliminates, or at least minimizes, the barriers that might otherwise be raised.

Since the feasibility study is likely to be the first step in a long, evolutionary process of change, it was imperative that the study be conducted by an independent group that has the requisite objectivity and skill to first build understanding, and then, concensus. The management consulting firm of A. T. Kearney, Inc. was selected in March 1984 to conduct a study with the following objectives:

1) Identify opportunities to improve productivity in the dry grocery industry through improvements in shipping container design.

2) Assess those opportunities for technical and marketing feasibility.

3) Develop generic guidelines for improved shipping container design.

4) Develop a vehicle to assist in gaining industry wide consensus.

The Associations agreed that the objectives might best be achieved by a three-phased approach. The specific objectives for Phase I are outlined below:

1) Identify opportunities for improvement in container design.

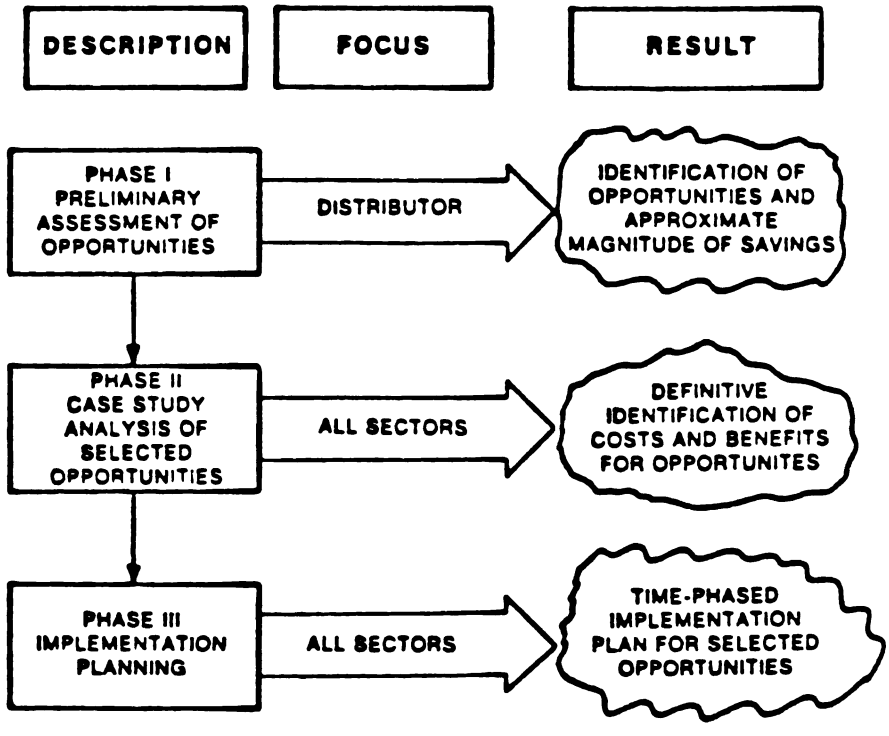
2) Assess the approximate magnitude of benefits for distributors only.

3) Identify barriers which impact change.

4) Recommend actions for Phase II.

As pictured in the figure below Phase I deals with distributors only. Phases II and III deal with all sectors of the industry.

Strategy of Approach

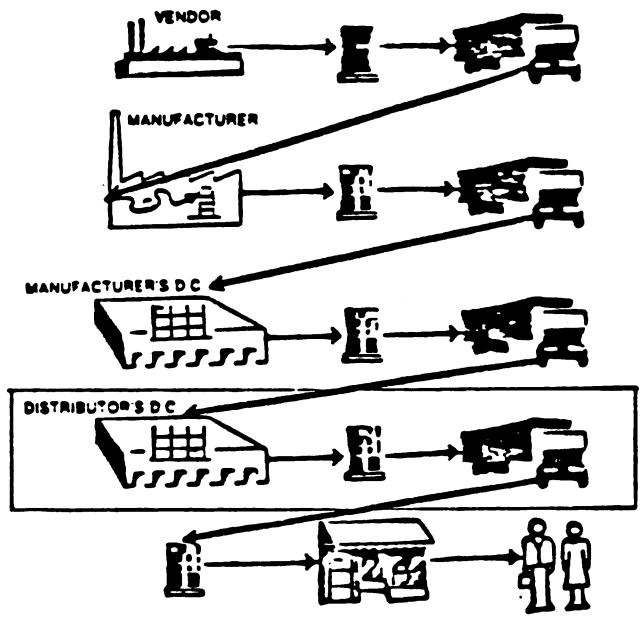


II - SCOPE

SCOPE

The scope of the study covers shipping containers that move through "normal" channels from manufacturers to distributors and on to the retail outlets. Phase I, however, deals with distributors only and is pictured below in the boxed area.

Phase I — Scope



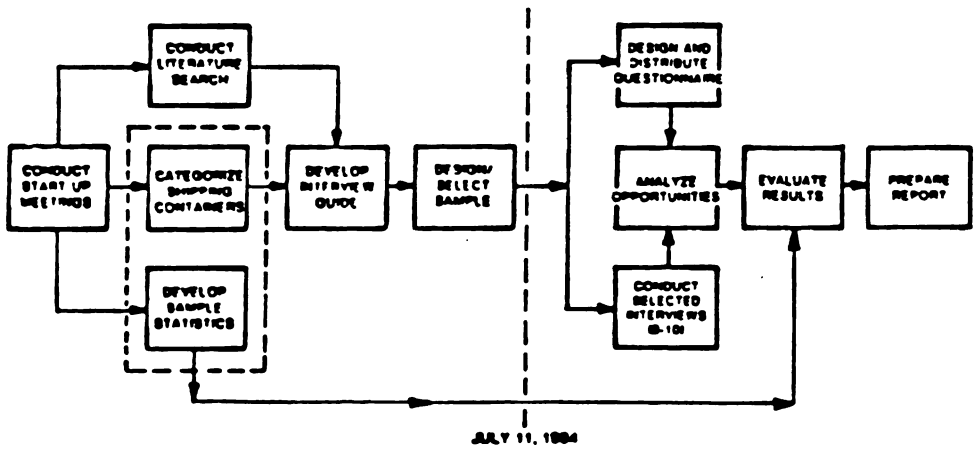
III - METHOD OF APPROACH

METHOD OF APPROACH

In mid March 1984 a start-up meeting was held with representatives of the sponsoring trade associations. At that time, a Joint Industry Committee was chosen, representing distributors and manufacturers to oversee the project and to provide input for its completion. Appendix III-1 is a listing of committee members.

The Phase I method of approach is depicted in the figure below:

Method of Approach Phase I



(a) Conduct Literature Search

A literature search was conducted to assess the work that had

already been done in the field, to determine what had been recommended in the past and what improvements had been achieved.

The search revealed that very little had been done in the last 10 years. Most work that had been done was of a technical nature such as:

- Lansmont Study on Shipping Container Strength, 1976
- FMI-NAWGA Damage Surveys, 1977
- Modularization Study, 1974

(b) Categorize Shipping Containers

To help provide a structure for the study, dry grocery SKU's were categorized by various attributes of the secondary shipping container. The shipping container attributes included:

- Secondary container type
- Primary container type
- Case pack
- Over/underhang pallet
- Shrink wrap
- Case weight
- Closure type
- Case dimensions
- SIC code

A data base was constructed for approximately 4900 dry grocery SKU's which can be sorted by the attributes listed above.

(c) Develop Sample Statistics

Once the dry grocery product lines had been categorized into container types, estimates of case volume were developed. The statistics were expressed as case counts for each major product grouping and/or shipping container type. Department of Commerce, and Bureau of Census data were the primary sources of these statistics.

(d) Develop Interview Guide

Once steps (a) through (c) were complete, an interview guide was developed as shown in Appendix III-2. As orginally planned, A. T. Kearney was to interview 30-40 Distributors to collect data and further insights into cost and benefits of potential opportunities in shipping container design.

(e) Design/Select Sample

A list of potential interview respondents was developed and presented to the Joint Industry Committee at a progress review meeting held on July 11, 1984. At that time it was decided that the approach should be changed and a questionnaire should be mailed to all participating trade association members. It was decided that the actual interview process would be limited to eight to ten distributors. This revised approach was taken to allow all members of the trade associations to participate in developing the industry perceptions of problems/opportunities in shipping containers.

(f) Design Questionnaires

A new, shorter version, industry questionnaire was developed and mailed to trade association members. Appendix III-3 provides the revised questionnaires.

(g) Conduct Interviews

In order to validate the information received from the questionnaires a series of nine interviews were conducted with selected distributors. The purpose of these interviews were to:

- Collect Productivity Data
- Collect Damage Data
- Validate distributor perceptions of problems and solutions

(h) Analyze Opportunities and Evaluate Results

Once steps (a) through (g) were completed, a framework for analysis was established to capture and quantify the impact of change on three basic warehousing costs. These included:

- Warehouse Labor Productivity
- Space Utilization
- Damage

Since the Phase I objective was to gain a rough order of magnitude of savings, not all three areas were used to estimate savings potential for each opportunity identified. Rather, savings opportunities were estimated for only the largest and most obvious of the three areas mentioned above.

The impact of these three areas was measured against the transportation and warehousing functions shown below.

Analytical Framework

DISTRIBUTOR IMPACT MATRIX

	LABOR PRODUCTIVITY	SPACE UTILIZATION	DAMAGE
INBOUND TRANSPORTATION			
RECEIVING			
PUT-AWAY			
PICK		Areas of potential improvement for distributors	
LOAD			
TRANSPORTATION TO STORE			
OTHER			
SEVERITY	*Dollar savings order of magnitude*		

(i) Prepare Report

The results of Phase I were summarized and presented to the Joint Industry Committee on October 9, 1984.

IV - FINDINGS

FINDINGS

(a) Industry Perceptions

The results of the industry survey yielded some surprising results. Surveys were returned by 31 manufacturers and 55 distributors. The tables below detail the results of those surveys.

Industry Perceptions — Manufacturers

- Areas of shipping container complaints from dry grocery customers

	Number of Respondents	Percent
— Damage	13	42
— Overhang	11	35
— Markings	7	23
— Stackability	6	19
— Poor closures	5	16
— Shrink wrap	4	13
— Glue between layers	1	3
— Low density	1	3
— Kraft overwrap	1	3
— Bails	1	3
— Hard to open cases	1	3
— Razor damage	1	3
— "No problems"	2	6
— "No data"	2	6
— "Non-dry grocery"	2	6

Total of 31 Manufacturer Survey Respondents

Industry Perceptions — Distributors

- Shipping container problems/issues affecting productivity in the dry grocery industry

	Number of Respondents	Percent
— Low-strength cases	26	47
— Bags	19	35
— Overhang	17	31
— Too many sizes	13	24
— Tray packs	12	22
— Plastic containers	11	20
— Shrink wrap	10	18
— Markings	7	13
— Poor closures	5	9
— Square cases	4	7
— Low-strength inserts	4	7
— Hidden damage	3	5
— Glue between layers	2	4
— High-cube items	2	4
— Bailed bags in plastic	2	4
— Hard to open cases	2	4
— Kraft overwrap	2	4
— Bags bailed in paper	2	4
— Pallet interlock	1	2
— Nonconveyorable items	1	2

Total of 55 Distributor Survey Respondents

No single problem/issue was identified by more than 50% of the respondents. A review of the manufacturer's and distributor's perception range from "no problems", to serious problems in damage, overhang, low strength cases, and bags, resulting in an industry perception that there are no universal problems and therefore, no universal solutions. Survey responses were analyzed and identified

as falling into one of five "family" groupings. These family groupings are as follows:

- o Dimensions - Opportunities relating to the size of the secondary shipping container itself. Examples would include over/underhang and standard pallet height.
- o Strength - Opportunities that relate to case strength. Examples would include interior case dividers and weak bags.
- o Closures - Opportunities that relate to the way the shipping case has been sealed. Examples would include end opening cases and damage caused by razor cutting to open the case.
- o Markings - Opportunities that relate to product identification on the exterior of the shipping case. Examples would include standardized code dating and UPC bar coding application.
- o Other - All other identified opportunities that do not apply to the categories listed above. Examples would include the minimization of between-tier gluing and improved Bric-Pack containers.

A total of 29 identified opportunities for improvement in shipping container design were identified. These opportunities are listed below according to these family groupings.

Recap of Opportunities

Dimension

D-1 Standardization
D-2 Chimney Stacking
D-3 Standard Case for Like Retail Pack
D-4 Standardized Carton Height
D-5 Overhang/Underhang
D-6 Reduced Pack Count on High Cube Items
D-7 Reduced Case Weight
D-8 Standard Pallet Height
D-9 Height Greater than Length or Width

Strength

S-1 Perforated Display Case
S-2 Eliminate Gap Flaps
S-3 Tray Pack Case Integrity
S-4 Eliminate Kraft Wrap
S-5 Interior Case Dividers
S-6 Bags

Closures

C-1 Gluing
C-2 Cutter Damage
C-3 End-Opening Cases

Markings

M-1 Visibility of Marking on Tray Pack
M-2 Improve Legibility of Markings
M-3 Use of Nonglare Stretch Wrap
M-4 Standardized Code Dating
M-5 UPC Bar Coding Application

Other

O-1 Slip Sheet Crimping
O-2 Pallet Integrity for Small Light Cases
O-3 Improve Brick-Pack Containers
O-4 Minimize Between-Tier Glue
O-5 Minimize Stretch Wrap
O-6 Tray Pack Picking

(b) Basis for Order of Magnitude Savings Estimates

The above 29 identified opportunities were evaluated by measuring the impact on three specific aspects of distributor warehousing operations. These were warehouse labor productivity,

space utilization and damage. The basis for determining these estimates for these categories is as follows:

Warehouse Labor Productivity

Levels of warehouse productivity were developed from a variety of industry sources. These included previous Kearney studies, various industry sources, as well as data obtained during our field interviews. The table below represents distributor warehouse productivity rates used in our analysis.

Labor Productivity Rates

	Cases/Hour	Cost/Case
Unload		
- Rail	650	$0.0130
- Truck	710	0.165
Put-away	1300	0.0090
Pick	180	0.0650
Load	750	0.0156

These productivity rates combined with an average hourly wage of $11.68 per hour formed the basis for determining saving opportunities in warehouse labor productivity.

Space Utilization

Public warehousing costs were used to apply savings in the area of warehouse space utilization. Savings in this area are related to reduced public warehousing costs, more SKU in-house storage space availability, and, deferred expansion.

Damage

Based on Kearney interviews and past studies it was estimated that distributor damage amounts to approximately $200 million annually. While no detailed data was collected during the first phase of this study, previous research forms the basis for these damage estimates. The results of these earlier studies are presented below along with the working assumptions used by Kearney.

Basis for Estimates — Phase I

DAMAGE BY PRIMARY CONTAINER

CONTAINER TYPE	ADL(1) %	NAWGA(2) %	PMI(3) %	WORKING ASSUMPTIONS(4) %
BAGS	39.9%	32.8%	34.0%	34%
GLASS	20.5	21.8	16.0	16
PLASTIC	12.3	-	17.0	17
CANS	12.3	22.0	12.0	12
BOX	13.7	17.9	17.0	17
OTHER	-	5.4	4.0	4
	100.0%	100.0%	100.0%	100%

Sources (1) An Examination of the Effects of Modularization of Secondary Containers on Productivity in Grocery Distribution, A. D. Little Inc. for the National Association of Food Chains 1974
(2) "NAWGA Damage Control Manual Reports" NAWGA 1974
(3) "Report of the Food Industry Committee on Packaging" PMI, 1977
(4) Composite percentages used in this study

Estimates of damage per case were calculated by combining case data collected earlier in the study and damage data presented on the previous page. The results are presented below.

Basis for Estimates — Phase I

DAMAGE COST BY PRIMARY CONTAINER

CONTAINER TYPE	PERCENT OF TOTAL DAMAGE(1)	DOLLAR DAMAGE ($ MILLIONS)	TOTAL CASES (MILLIONS)	DAMAGE PER CASE
BAGS	34%	868	233	$0.292
GLASS	16	32	5,154	0.006
PLASTIC	17	34	2,068	0.016
CANS	12	24	2,101	0.011
BOX	17	34	2,889	0.012
OTHER	4	8	460	0.017
	100%	$200	12,905	$0.015

The data presented above forms the basis for the estimates of saving potential for each of the 29 opportunities listed earlier.

The results of the analysis of savings opportunities are presented below in "a rough order of magnitude" and should not be taken as precise. During Phase II of the study a more detailed approach will be used to more accurately identify savings.

Recap of Opportunities

		Cases Impacted (Millions)	Order of Magnitude Savings to the Distributors* (Millions)
	Dimensions		
D-1	Standarization	11,400	$116.0
D-2	Chimney Stacking	100	2.6
D-3	Standard Case for Like Retail Pack	1,400	14.2
D-4	Standardized Carton Height	11,400	23.2
D-5	Overhang/Underhang	4,800	2.8
D-6	Reduced Pack Count - High Cube	N/Q	N/Q**
D-7	Reduced Case Weight	683	N/Q**
D-8	Standard Pallet Height	12,900	23.6
D-9	Height Greater than Length or Width	4,800	5.5
	Strength		
S-1	Perforated Display Case	315	1.0
S-2	Eliminate Gap Flaps	N/Q	N/Q**
S-3	Tray Pack Case Integrity	79	1.3
S-4	Eliminate Kraft Wrap	300	0.5
S-5	Interior Case Dividers	5,400	8.7
S-6	Bags	233	64.4
	Closures		
C-1	Gluing	114	2.3
C-2	Cutter Damage	3,300	N/Q**
C-3	End-Opening Cases	N/Q	N/Q**
	Markings		
M-1	Visibility of Marking on Tray Pack	791	0.1
M-2	Improve Legibility of Markings	12,900	1.6
M-3	Use of Nonglare Stretch Wrap	7,700	N/Q**
M-4	Standardize Code Dating	839	7.2
M-5	UPC Bar Coding Application	12,900	N/Q**
	Other		
O-1	Slip Sheet Crimping	N/Q	N/Q**
O-2	Pallet Integrity for Small Light Cases	3,300	0.3
O-3	Improve Bric-Pack Containers	36	0.1
O-4	Minimize Between-Tier Glue	1,000-2,000	3.5
O-5	Minimize Stretch Wrap	2,100	8.7
O-6	Tray Pack Picking	300	1.9

*Opportunity savings not additive
**Not quantified

V - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Once secondary packaging opportunities were identified and then quantified, it was necessary, for Phase II of the study, to select several of these opportunities for a more detailed analysis.

(a) Key Issues

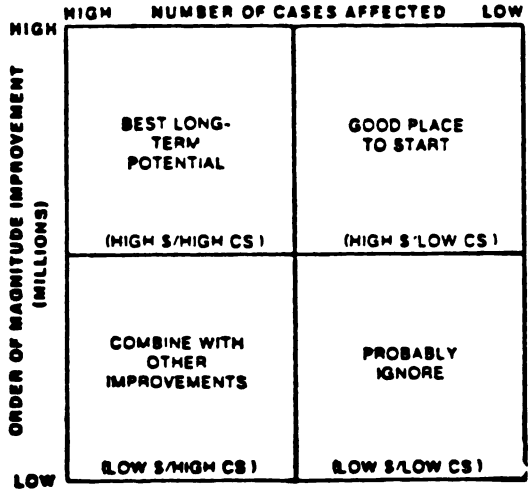
Phase I of the study identified 29 opportunities with savings ranging from a low of $100,000 for an opportunity to over $116 million for another opportunity. In addressing these opportunities, several key issues had to be considered. First, for those opportunities where identified savings were relatively small, there is some concern that cost control systems within the distributor environment lack the sensitivity to measure low levels of improvement. This suggests that they be subordinated to opportunities offering more potential. Second, other opportunities seemed to impact individual distributors and manufacturers far more than others. Sensitivity needs to be shown to probable affect this would have on implementation. And, finally, consideration needed to be given to an estimate of the benefits that could be expected given a piecemeal implementation of the opportunities. In the ultimate analysis, the key issue

became identification of what realistic improvements could be expected from implementation, rather than theoretical improvements that are less likely to be realized.

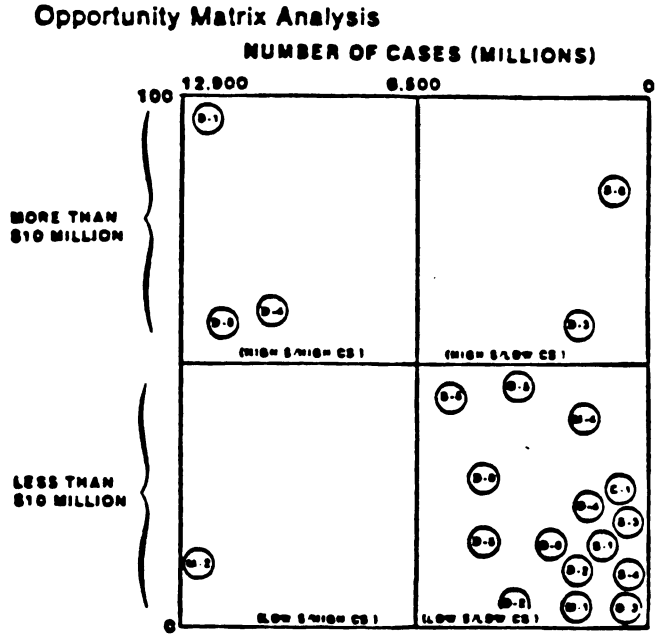
(b) Distributor Opportunity Matrix

Opportunities that offer substantial savings opportunity and at the same time impacted relatively low numbers of cases is the best place to begin industry efforts for Phase II. These opportunities fall into the upper right quadrant of the matrix. The matrix below was used to plot the individual opportunities according to the variables listed in the matrix.

Distributor Opportunity Matrix



The completed matrix below shows the location of the identified opportunities.



(c) Recommendations for Phase II

The results of Phase I of the study identified 2 specific opportunities that should be addressed by the industry in Phase II. These are:

D-3 Standard Case for Like Retail Pack

Standardization of the shipping containers for products with the same retail pack would yield benefits similar to the modularization concept, reducing damage, and increasing load stability. Approximately 1.3 billion

cases are impacted and include 303 cans, baby foods, and gelatins and represent approximately 10% of total Dry Grocery products.

S-6 Strength-Bags

Lack of strength in bags has long been a highly visible industry problem. Bags represent approximately 5 percent of total case volume but 34 percent of the total damage in the industry.

Addressing this issue in Pnase II has several advantages. The solutions methodology is relatively clear. Costs and operating tradeoffs can be easily judged and in addressing this issue we put this highly visible problem into perspective.

Phase I identified the need for a joint industry efforts to reaffirm commitment to voluntary industry standards in areas of case markings, overhang/underhang of product, use of "standard" 48" x 40" pallet, and case construction. Compliance with these issues by some members of the industry are severely lacking and there is a need to develop a framework for more consistent and uniform concentration in these important areas.

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