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COLLEGE OF APPLIED SCIENCE AND TECHNOLOGY
ROCHESTER INSTITUTE OF TECHNOLOGY
ROCHESTER, NEW YORK

CERTIFICATE OF APPROVAL

M.S. DEGREE THESIS

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BY THE THESIS COMMITTEE AS SATISFACTORY
FOR THE THESIS REQUIREMENTS FOR THE
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Date

Analysis of Packaging Based Determinant
Attributes for Minimally Processed
Vegetables: A Foodservice End-Use Study

by

James A. Myers

A thesis submitted to the faculty of
the Department of Packaging Science at
Rochester Institute of Technology in partial
fulfillment of the requirements for the degree

of

Master of Science

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ABSTRACT

ANALYSIS OF PACKAGING BASED DETERMINANT
ATTRIBUTES FOR MINIMALLY PROCESSED
VEGETABLES: A FOODSERVICE END-USE STUDY

By

James A. Myers

The objective of this study was to determine what packaging based attributes most influence the purchasing decision of foodservice operators. The study was limited to those packaging attributes associated with minimally processed vegetables. A survey instrument was used to poll operators from various segments of the foodservice industry. Factor analysis was employed in an effort to identify attributes with degrees of communality. It was determined that attributes associated with the utility function of foodservice packages were of primary concern. These attributes were linked to the challenges of handling products in the foodservice environment. Factor loadings were significant on two other factors. These factors were linked to cost and control function of the package, and social issues associated with foodservice packaging.

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INTRODUCTION AND STATEMENT OF RESEARCH

The technical challenges of designing and manufacturing packages for the food industry are well known to most packaging scientists. The constraints placed upon the package by the physiological and biochemical nature of the food product, are often of principal concern. The limitations of existing materials and processing technologies help to further focus and limit the scientist's viable design options. Ultimately, customer or end-user requirements are considered, and relevant "features" added to the product and package. The challenge is further complicated by the complex legal environment associated with food safety and consumer information.

Customer Driven Quality

The Malcolm Baldrige National Quality Award was established as a challenge to American industry, and a vehicle for recognizing quality oriented companies. Since its creation in 1987, with passage of the Malcolm Baldrige National Quality Improvement Act, the award has served as an impetus for a national focus on quality manufacturing and Total Quality Management (TQM). (Surak, 1992)

The roots of TQM principles can be found in the criteria for the Baldrige Award. Many companies have implemented structural and process changes by using the Baldrige Quality Award criteria as a guideline. (Surak, 1992)

For purposes of introducing the tenor of this paper, it is important to note the emphasis placed on "Customer Focus and Satisfaction" as a Baldrige Award criteria. Of the seven categories used for the award; "Customer Focus and Satisfaction" represents three hundred (300) points out of the one thousand (1000) point total. (NIST, 1991) (Surak, 1992) This category is given more emphasis than any of the six other categories. The seven categories identified for the 1992 Malcolm Baldrige Award are (NIST 1991, Surak, 1992)

<u>Category</u>	<u>Points</u>
1. Leadership	90
2. Information and Analysis	80
3. Strategic Quality Planning	60
4. Human Resource Development and Management	150
5. Management of Process Quality	140
6. Quality and Operational Results	180
7. Customer Focus and Satisfaction	300
Total	1000

The "Customer Focus" category is further broken down into six sub-groupings with corresponding points. (NIST 1991, Surak 1992)

<u>Sub-group</u>	<u>Points</u>
Customer Relationship Management	65
Commitment to Customers	15
Customer Satisfaction Determination	35
Customer Satisfaction Results	75
Customer Satisfaction Comparison	75
Future Requirements & Expectations of Customers	<u>35</u>
Total	300

It is in the context of TQM, and specifically the customer focussed concepts of TQM, that the following research has been conducted. The principal challenge is to identify customer based requirements placed upon a narrowly defined group of packaged food products.

Determinants and Measurement of Customer Satisfaction

Customer satisfaction with a product is presumed to lead to multiplicative benefits to the producer/manufacturer. These benefits extend beyond repeat purchases to include the purchase of peripheral products, acceptance of line extensions and overall positive goodwill. (Cardozo, 1965) As a result, the factors contributing to satisfaction, and the mental processes associated with satisfaction determination, have been a focus of business

research for three decades. A great deal of the research evolved out of social psychology and consumer behavior. Central to most of this research is the premise that customers form attitudes toward products and services. (Alpert, 1971)

Attitude formation is a function of beliefs about an object's possession, or dispossession, of a particular attribute. Once the customer determines the existence of an attribute, the evaluative process allows for the determination of the importance of the attribute to overall satisfaction. Degrees of importance are assumed to be assigned to each perceived attribute. The theories associated with the formation of attitudes towards objects has yielded two principle theories associated with customer satisfaction. One theoretical perspective focuses on the belief's associated with a product's attributes. The second dimension has focussed on the importance of the attributes, and assigning degree measures to the attributes. (Alpert, 1971)

Disconfirmation theory is widely accepted as a model for the processes by which customers develop feelings/beliefs of satisfaction or dissatisfaction. The disconfirmation paradigm involves a four component sequence. The customer's expectations reflect either some previous experience with the product, or some preconceived notions of the product. The use of the product (performance) will result in disconfirmation if there is a discrepancy (positive or negative) between performance and

expectation. If performance meets expectation then confirmation will result. Overall satisfaction is determined by summing the satisfaction outcomes for the product attributes. (Ryan and Holbrook, 1982)

The Expectancy Value Theory suggests customers make some assessment of a product, its benefits and the possible outcomes of use. The Expectancy Value paradigm assumes that customers act on what they value and what they expect will result from their actions. Fishbein's explanation of attitude formation is presented algebraically:

$$A_b = \sum_{i=1}^n b_i e_i$$

A_b ----> the attitude toward the performance of a behavior

b_i ----> the belief that the behavior leads toward or away
from an outcome "i"

e_i ----> the evaluation of the outcome

n ----> the number of salient outcomes

(Fishbein, 1976)

In an effort to focus marketing strategies; marketers are frequently forced to limit their research to the outcomes of primary importance. In essence the marketer is forced to substitute "importance" for more open evaluative responses. This substitution presents theoretical difficulties since importance is unipolar and indicates only intensity. Evaluation is bipolar and ranges from "strongly positive" to "strongly negative." For

example; the ability to recycle a package may be important because the purchaser is genuinely concerned about the environment and solid waste issues. Another purchaser may consider recycling important because it is mandated and fines are imposed for failure to recycle. Though each purchaser may assign a high degree of importance to the package recycling variable, their attitudes toward recycling may range from "positive" to "negative." The attitude measure is not reflected in the importance rating. (Ryan, Holbrook, 1982)

The direct substitution of importance for attitudinal measures has been debated and alternatives proposed. In general, efforts have been made to incorporate importance into the expectancy-value models. (Ryan, Holbrook, 1982) Incorporation of importance has been proposed as a basis for establishing determinant attributes. (Alpert, 1971)

Determinant attributes are those product attributes which determine purchase behavior. Marketing theorists suggest importance yields insight in to the degree to which a customer's attitude towards an attribute stimulates purchase. In essence, positive attitudes towards attributes are not always determinants of purchase behavior. This is especially true when the customer is presented with multiple attributes. In the recyclable package scenario; the customer may have strongly positive attitudes towards the recycling attribute, but places a higher relative

degree of importance on the cost of the product. When faced with the purchase decision, the same customer may select a non-recyclable product based on the price of the product. The purchaser assigns a higher relative degree of importance to those attributes which determine purchase behavior. The customer's attitude towards the product is generally considered in conjunction with the relative importance placed on specific product attributes. (Fishbein, 1976) (Alpert, 1971) (Cardozo, 1965) (Ryan & Holbrook, 1982)

The ability of a product to deliver satisfaction to the customer is a function of the customer's expectations of the product, the customer's attitudes towards the product, and the presence of determinant attributes. This relatively simple relationship becomes more complex as the customer's expectations and attitudes are influenced by experiences with competitive products and substitutes. (Desatnick, 1992) A number of algorithms have been developed to represent the relationships between satisfaction/dissatisfaction and previous experience with the product and supplier. These paradigms present a direct relationship between satisfaction and customer retention. The models also factor in the customer's previous experience with the principal supplier and other suppliers. The following algorithm establishes such a relationship:

$$A_{t+1} = A_t(1-X) + B_tY \left[\frac{A_t}{(A_t + C_t)} \right] + C_tZ \left[\frac{A_t}{(A_t + B_t)} \right] + G \left[\frac{A_t}{(A_t + (A_t + B_t + C_t))} \right]$$

$$B_{t+1} = B_t(1-Y) + A_tX \left[\frac{B_t}{(B_t + C_t)} \right] + C_tZ \left[\frac{B_t}{(A_t + B_t)} \right] + C_tZ \left[\frac{B_t}{(A_t + B_t)} \right] +$$

$$G[(B_t/(A_t+B_t+C_t))]$$

$$C_{t+1}=C_t(1-Z)+A_tX[C_t/(B_t+C_t)]+B_tY[C_t/(A_t+C_t)]+G[C_t/(A_t+B_t+C_t)]$$

Where:

A = Number of product/supplier A customers

B = Number of product/supplier B customers

C = Number of product/supplier C customers

G = Number of new customers to market

X = Dissatisfaction level with A products

Y = Dissatisfaction level with B products

t = Time

(Desatnick, 1992)

The X and Y factors determine the probability of customer leaving supplier A or B in favor of supplier C. In theory the trade off from supplier to supplier (based on levels of dissatisfaction) could extend infinitely through time. In reality, customers will seek product substitutions if a group of products and suppliers consistently fail to meet their expectations. (Desatnick, 1992)

The inability of food manufacturers to recognize and meet the needs of the fast food industry, has resulted in the industry abandoning traditional supplier relationships. The fast food industry has a long history of internalized research and development, sub-contracting, and unique leasing arrangements; each designed to solve some of its supply challenges. The industry has attempted to "manage" supplier failure by creating detailed specifications and, in many cases, forward contracting

with suppliers and distributors to guarantee supply and quality.
(Hale and Brody, 1972)

The research presented in this paper focusses on the measure of package attribute importance, and is intended for use by fresh produce processors. The goal is to help build a foundation for the supply of high quality, user-friendly minimally processed products to the foodservice industry.

Purpose of Study

The purpose of this study is to; (1) Review and discuss customer focussed concepts of package and product quality for the end-users and products identified in this study, (2) To measure the performance importance of packaging attributes for the products and end-users identified in this study, (3) Develop a descriptive model of package and product purchasing criteria for the foodservice end-users of the product identified in the study.

Problem Statement

The product quality expectations of the customer, or end-user, of a foodservice product must be considered throughout the product development process. The complexity of the distribution system and perishability of such products places unique demands on the package. These demands are further complicated when fresh

minimally processed produce items are the product of concern.

Objective

Foodservice end-users have definitive expectations associated with packaging of minimally processed produce. These expectations are associated with specific cost and performance criteria.

Chapter II

Literature Review

In a special report entitled Scholarship Reconsidered: Priorities of the Professorate; Ernest Boyer outlines four definitions of scholarship: the scholarship of discovery, the scholarship of integration, the scholarship of application and the scholarship of teaching. Boyer proceeds to define each dimension of scholarship and gives each rightful place in the realm of research and scholarly activity. In defining "scholarship of integration" Boyer may be quoted: "By integration, we mean making connections across the disciplines, placing the specialties in larger context, illuminating data in a revealing way, often educating nonspecialists, too." (Boyer, 1990) Integration is the essence of multidisciplinary study and research.

The research presented in this paper is multidisciplinary in nature. In some respects it is marketing research; in other respects it is packaging research. To do justice to both disciplines requires review of literature from both fields. Given the relative uniqueness and industrial nature of the market being researched, it is also necessary to review literature which gives shape and definition to the foodsystem as a whole. Though the disciplines may appear far-a-field there is a unifying theme: the package is a vital dimension of customer satisfaction, and customer satisfaction is a central tenet of Total Quality

Management, both philosophically and in practice.

Structure and Organization of the Foodsystem: Role of Foodservice

The structure of the U.S. foodmarket has changed drastically in the past decade. The market is not now, or has it ever been, static. The dynamics shaping the market throughout the 1980's continue to influence and alter the way food ultimately reaches the consumer. The consumer is at the center of these changes. The demographic and lifestyle revolution of the late 1970's and early 1980's have had a ripple affect across many markets - food markets included. These changes are coupled with a growing demand, by an aging "baby boomer" population, for well balanced and nutritionally sound foods. Forty Nine percent of Americans view food as more important to personal health than exercise. (Barkema, et al. 1991)

Changing consumer demand has resulted in a shift away from foods that were long considered staples in the American diet. (see table 1.0) On the surface the consumer is sheltered from how these changes have altered the foodsystem, but decreasing consumption ultimately leads to a decrease in production and conversely.

As table 1.0 demonstrates, there has been exceptional growth in the consumption of a number of fresh vegetable items. Increasing consumer demand for fresh fruits and vegetables places

pressure on a distribution system primarily focussed on the logistics surrounding retort and frozen foods (Barkema et al. 1991).

Table 1.0

Shifting Food Demand

Largest Increases and Decreases in Consumption

	<u>Percent Change</u>
<u>Food Consumption Gains</u>	<u>1976-78 to 1986-88</u>
Fresh Broccoli	231.8
Low Calorie Sweeteners	193.2
Fresh Cauliflower	174.1
Fresh Grapes	134.8
Rice	95.1
Yogurt	89.4
Fresh Carrots	77.0
Frozen Broccoli	67.6
Turkey	62.7
Cheese (excl. cottage)	46.0
	<u>Percent Change</u>
<u>Food Consumption Losses</u>	<u>1976-78 to 1986-88</u>
Veal	-46.1
Whole Milk	-33.8
Canned Green Peas	-32.8
Canned Peaches	-27.8
Distilled Spirits	-25.2
Nonfat Dry Milk	-23.2
Canned Corn	-19.6
Beef	-17.8
Coffee	7.5
Lamb	- 8.8

Source: "Food Consumption, Prices and Expenditures," 513-804, U.S.D.A., ERS, May 1990.

Lifestyle changes have further created demand for an array of convenience foods. The driving force behind this consumption pattern is the emergence of the dual income family. Nearly 75% of the women aged 25-54 are now in the workforce. Comparatively, twenty years ago less than 50% of the same age group of women were part of the workforce. As a result, most households have

reduced the amount of time spent preparing food. The alternative is to purchase food products with convenience built into them. This dimension of convenience may mean the purchase of a partially or fully prepared food item. The consumer may also choose to eat outside of the home, or have already prepared food product delivered to the home (e.g. delivered pizza). (Barkema, et al. 1991) The food package plays a vital role in the convenience function regardless of the chosen venue (in-home or out of home).

The consumption of food outside of the home has grown consistently for the past two decades. Consumer expenditures in foodservice market segments have grown from \$52.9 billion in 1972 to an astounding \$261.8 billion in 1991. (Data Digest, 1991)

Comparison of consumer expenditures in foodservice, to equivalent expenditures in the traditional retail segments, yields further insight into the shifts taking place in the foodsystem. (See table 1.1) Much of the growth in foodservice would appear to come at the expense of the retail segment. Comparison of percent equivalent expenditures across each segment, indicates that foodservice expenditures have been growing while the percent equivalent expenditure in retail has been declining (see table 1.2).

The consumer's demand for convenience has created immense

opportunity for both foodservice operators, and manufacturers supplying the foodservice industry. (Data Digest, 1991)

Table 1.1

Foodservice/Retail
Equivalent Consumer Expenditures
1972-1991
Current Dollars (\$ B)

<u>Year</u>	<u>Foodservice</u>	<u>Retail</u>
1972	\$52.9	\$84.9
1973	59.8	95.5
1974	67.0	107.9
1975	74.5	118.5
1976	82.3	126.7
1977	90.9	135.7
1978	101.5	148.0
1979	114.5	164.6
1980	125.1	180.4
1981	135.8	190.5
1982	145.6	195.2
1983	155.8	201.2
1984	166.1	211.5
1985	175.0	219.6
1986	188.1	226.6
1987	204.5	234.3
1988 (R)	220.7	247.2
1989 (R)	232.1	261.3
1990 (R)	249.9	269.2
1991 (P)	261.8	277.8

(R) = Revised

(P) = Preliminary

Source: U.S. Department of Commerce, Bureau of Census;
Technomic, Inc.

Table 1.2

Foodservice/Retail Penetration
Percent Equivalent Consumer Expenditures
1972-1991

<u>Year</u>	<u>Foodservice</u>	<u>Retail</u>
1972	38.4%	61.6%
1973	38.5	61.5
1974	38.3	61.7
1975	38.6	61.4
1976	39.4	60.6
1977	40.1	59.9
1978	40.7	59.3
1979	41.0	59.0
1980	41.0	59.0
1981	41.6	58.4
1982	42.7	57.3
1983	43.6	56.4
1984	44.0	56.0
1985	44.4	55.6
1986	45.4	54.6
1987	46.6	53.4
1988 (R)	47.2	52.8
1989 (R)	47.0	53.0
1990 (R)	48.1	51.9
1991 (P)	48.5	51.5

(P) = Preliminary
(R) = Revised

Source: U.S. Department of Commerce, Bureau of Census; Technomic, Inc.

Some manufacturers have benefitted substantially from this shift in consumption. Other manufacturers have been slow to develop products, packaging and services which are targeted toward the foodservice industry. Producers, manufacturers and distributors of "fresh" products have captured the greatest proportion of operator expenditures. (see table 1.3) Fresh products accounted for \$40.45 billion in sales from manufacturers to foodservice operators. Fresh fruits and vegetables accounted for \$4.07 billion in sales. (Data Digest, 1991)

Table 1.3

1991

Manufacturers' Foodservice Sales

By Product Category

(\$ B)

<u>Product Category</u>	<u>Fresh</u>	<u>Frozen</u>	<u>Shelf Stable</u>	<u>Total</u>
Meat/Fish/Poultry	\$19.78	\$18.79	\$0.99	\$39.55
Fruits/Vegetables	4.07	4.07	1.79	9.93
Dairy Products	7.38	1.72	0.48	9.58
Bakery Products	6.35	1.02	0.47	7.84
Beverages	0.00	0.00	5.75	5.75
Fats/Oils	2.03	0.00	2.59	4.62
Prepared Foods	0.70	1.32	1.46	3.48
Sugar/Sweets	0.00	0.00	1.92	1.92
Flours/Cereals	0.00	0.00	1.57	1.57
Juices	0.14	0.84	0.42	1.39
Soups/Sauces	<u>0.00</u>	<u>0.44</u>	<u>1.04</u>	<u>1.48</u>
Total	<u>\$40.45</u>	<u>\$28.21</u>	<u>\$18.47</u>	<u>\$87.12</u>

Source: Technomic, Inc.

The changing demographic and lifestyle profile of the American consumer has created a fundamental shift in the way manufacturers market and distribute food products. The ever expanding demand for "fresh"/"healthy" foods is coupled with growing demand for convenience. The foodservice industry is uniquely positioned to provide both the value added benefits of convenience with a high degree of perceived freshness and quality.

Foodservice Market Segments and Distribution Channels

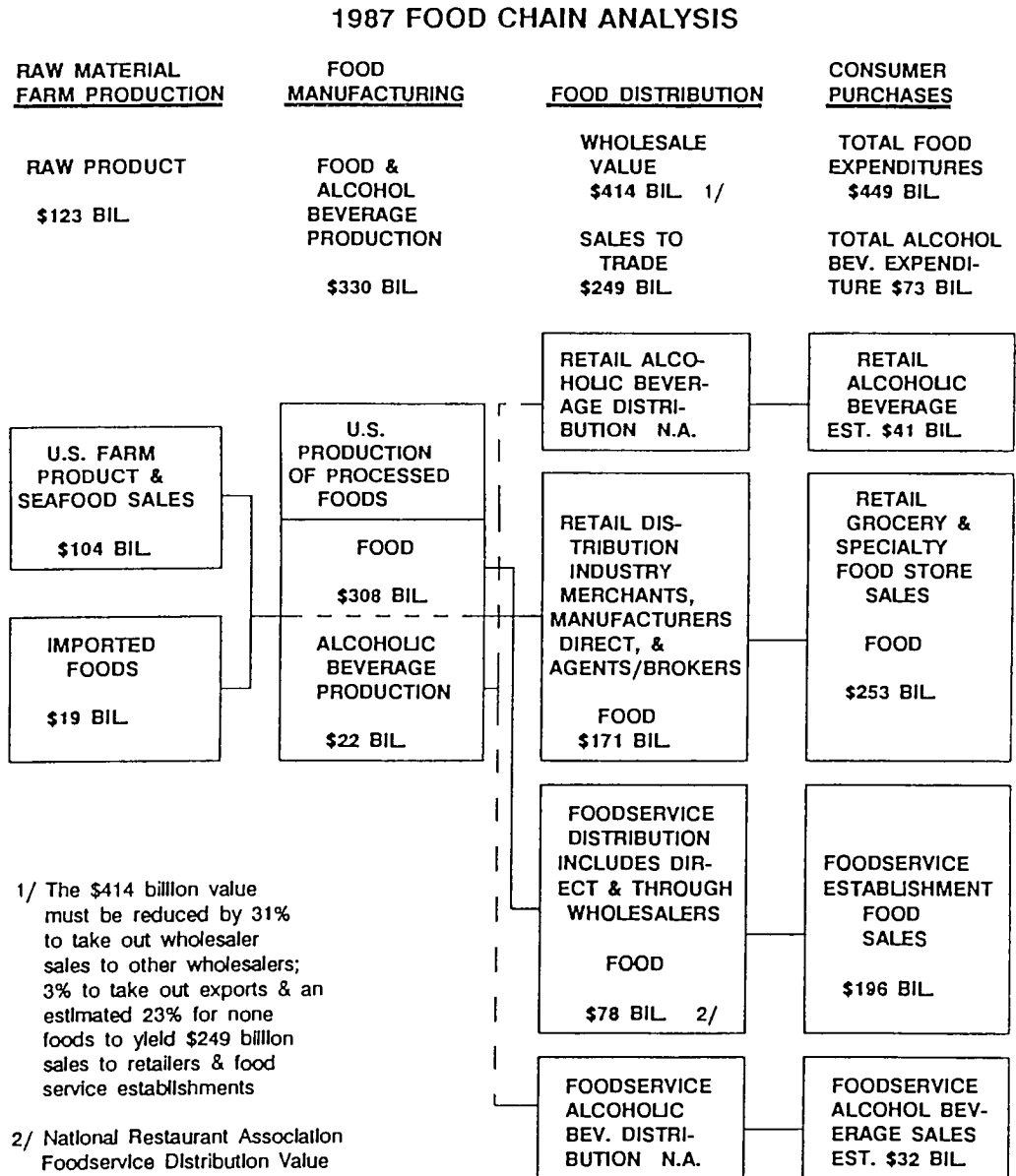
Food manufacturers, and grower/shippers of fresh produce,

are linked to foodservice operators by a complex network of distributors, brokers, and even retailers. The distribution network for foodservice differs from the retail distribution system both in terms of the channel structure and the approach to market segmentation. In retail channels the consumer is the end-user of the finished manufactured/processed or fresh food product. In foodservice channels the foodservice operator is the end-user of the product. The operator typically remanufactures, prepares or adds some other value dimension to the product before purchase by the consumer. (see figure 1.0)

Foodservice operators can be divided into two general categories: commercial and non-commercial operations. Each can be defined as follows:

1. "Commercial Establishments are public foodservice operations with the objective of preparing/serving and selling meals and snacks for profit to the general public. Commercial operation would include restaurants, specialty shops, taverns, resorts, hotels/motels, and recreational facilities." (FASI, IFMA, 1991)
2. "Non-Commercial Establishments are non-public operations where meals and snacks are prepared and served as an adjunct, supportive service to the primary purpose of the establishment. Non-commercial

Figure 1.0



SOURCE: U.S. DEPARTMENT OF AGRICULTURE, ECONOMIC RESEARCH SERVICE -

foodservice can be found in hospitals, prisons, military bases, schools and other institutional facilities." (FASI, IFMA, 1991)

Within each of these broader categories are segments which are further divided into subsegments:

Commercial Operations

1. Separate Eating Places
 - a. Refreshment Place (fast food)
 - b. Restaurants & Lunchrooms
 - c. Commercial Cafeterias
2. Retails Hosts
 - a. Convenience Stores
 - b. General Merchandise/Drugs
 - c. Other Retail Hosts
3. Lodging
4. Recreation
5. Separate Drinking Places

Non-commercial Operations

1. Business and Industry
2. Vending
3. Health Care
 - a. Hospitals
 - b. Nursing Homes
4. Primary and Secondary Schools
5. Colleges/Universities
6. Airlines
7. Military
8. Other Non-commercial

Source: FASI, IFMA, 1991

Complete volumes are dedicated to defining and establishing the scope of each segment listed above. The most thorough singular source is the International Foodservice Manufacturers Association. This organization has compiled substantial data on the domestic foodservice market and market segments. Annual statistics on the industry as a whole are published in The Data Digest. Data and definitions for each market segment are published on an annual basis in Foodservice: A Segmented Industry (FASI).

International Dimension of Foodservice

The research conducted in this paper focuses on the domestic foodservice market, but it is important to note the growing influence of international markets. Much of the literature suggests international expansion of U.S. foodservice operators will create unprecedented demand for foodservice products. Most of the literature focuses on the growth potential for foodservice operators in the Pacific Rim and Europe.

In some Pacific Rim markets, such as Hong Kong, U.S. operators, like McDonalds and Pizza Hut, are experiencing as much as 46% annual revenue growth. Seven of McDonalds eleven busiest units worldwide (based on sales) are located in the Pacific Rim. Only two of the company's eleven busiest units are in the U.S. (Restaurant Business, August 10, 1992).

Much of the Pacific Rim economic growth, throughout the 1980's, was fueled by a booming Japanese economy and general regional economic expansion. It is speculated that much of growth in the next decade will be fueled by the Chinese experiment in Capitalism. Many U.S. foodservice companies are actively pursuing opportunities in mainland China. McDonalds and Pizza Hut already have units in Beijing with plans for further expansion throughout Southern China. Southern China has had consecutive annual economic growth rates of 12.5% (Restaurant

Business, August 10, 1992).

The European market also offers opportunities for growth. Western Europe is comprised of 425 million people with access to 1.65 million foodservice operations serving 43 billion meals and snacks. Comparatively, the U.S. market has about 260 million people, with access to 780,000 outlets serving 64 billion meals and snacks. In essence, "the U.S. has 40% fewer people, and less than half the foodservice locations, but serves one and a half times as many meals and snacks." (Restaurant Business, May 1, 1992)

The largest European operators, McDonalds and Pepsico's Kentucky Fried Chicken (KFC), believe that Western Europe will continue to be a growing market throughout the 1990's. Each year U.S. foodservice operator's achieve greater market penetration, with the largest operators experiencing 2-3% annual market share growth. Currently, U.S. chain penetration has reached 14% in Britain, 15% in France, and 13% in Germany. Germany is seen as having the greatest potential market growth as a result of the union with former East Germany. Most operators believe the potential of Eastern Europe will not be realized until the end of the decade. Though McDonalds has built units in Russia, and is planning expansion in the Ukraine, the company believes the growth will be "slow" compared to other international markets. (Restaurant Business, May 1, 1992)

The global scope of the foodservice industry is paralleled only by the economic scale of the industry (as demonstrated in figure 1.0). It is an industry which is growing domestically and is in demand throughout the world. The U.S. foodservice operator is a significant potential customer for any food processor and should be considered when implementing product marketing strategies.

Foodservice Packaging

There is very little in the literature, which focuses on the specifics associated with packaging for the foodservice industry. A 1972 study conducted by the Foodservice Division of the Institute of Food Technologists outlines the nature of the industry's dissatisfaction with existing foodservice packages. This paper also details the dynamics which have shaped packaging systems for foodservice. Though it is somewhat dated, the study puts forth several packaging considerations which hold true in today's foodservice environment.

- 1) Control of costs is critical to profitability in foodservice operations. Specifically control of food and labor costs. The labor cost control is established by using relatively unskilled workers. Often these employees are part-time and transient. The food portion cost control objective is frequently obtained by utilizing preportioned and prepackaged products

whenever possible.

- 2) The skill level and labor cost objective mandate extensive engineering of food preparation systems. The food packaging must frequently communicate preparation procedures as well as systems procedures. For example, the french fry package must not only communicate frying procedures, but frequently must communicate proper storage temperature and post-preparation handling.
- 3) Most foodservice operations are limited by physical parameters. A substantial amount of space is dedicated to the preparation and storage function (as much as 60%). To the foodservice operator, each additional square foot of storage and preparation space represents additional cost; whereas space dedicated to serving customers represents revenue generating space. The operator's objective, in general, is to reduce the amount of space dedicated to storage and preparation function. An average cost food operation dedicates 7-9% of its total space to dry, frozen and refrigerated storage. (This percentage has remained constant while the average number of menu items has been expanding) (Date Digest, 1991) As a result packaging and products must "cube-out" well and reduce overpacking and waste. (Hale and Brody, IFT, 1972)

The IFT study further suggests that ecological issues associated with the disposal of foodservice waste will overshadow the operational challenges of designing packaging for foodservice operators. This would appear to be especially insightful given the negative publicity generated in the past five years by the visibility of expanded polystyrene food containers, and other solid waste issues. It is important to note, in reality, foodservice disposables are minimal contributors to the solid waste stream; contributing less than one half of one percent to the overall volume (in tons) of solid waste. ("Should I Feel Guilty" Foodservice Packaging Institute, 1990)

Foodservice Packaging of Fresh Vegetables

The bulk packaging of fresh vegetables for foodservice use differs very little from retail bulk packaging of fresh produce. At the retail level bulk produce may be repackaged in oxygen permeable flexible materials, allowing for retail unitization and convenience. (Bakker, Encyclopedia of Packaging, 1986)

In foodservice, the bulk package serves as the principal package throughout the use and storage life of the product. The bulk packaging of vegetables (such as the products presented in this study) will generally utilize wooden crates, corrugated fiberboard cases and occasionally high density polyethylene

netting. Cabbage packers frequently utilize header-label bags (HDPE, Netting) to ship fifty pound units. (Bakker, 1986) (Karst, 1993)

The bulk package presents problems in the foodservice environment. The refrigerated storage area is frequently a high moisture area and efforts to maximize space utilization results in improper stacking and compression of the case or carton. This frequently results in bruising, crushing and premature degradation of the produce item. (Hale & Brody, IFT, 1972).

The preparation of produce is a labor intensive activity. The cleaning, coring, shredding, chopping and dicing processes not only add labor costs to the food preparation function; there is also substantial waste generated, further contributing to shrinkage and food costs. Food processors seeking to provide value added products to the foodservice industry have developed a number of minimally processed or "fresh processed" products. (Hale & Brody, IFT, 1972) These fresh processed products would include any fresh fruit or vegetable which has been cleaned, cored, peeled, shredded, diced and chopped without further processing (such as blanching, freezing, etc.). (Packer, Oct. 5, 1991)

The fresh processing and packaging of vegetables plays a unique economic function beyond the cost components of the

foodservice operating environment. By adding value in the form of convenience and enhanced storage and shelf life characteristics, fresh processors can offer relatively stable pricing to foodservice operators. This is an invaluable dimension of these products. Unlike bulk vegetable items, which may experience extreme fluctuations in price and supply, fresh processed products can be priced at a relatively fixed level. Because the foodservice operator commits to a menu price for extended periods of time, the price stability of supplies is crucial to profitability. The retailer may simply discontinue stocking vegetable items once the price has become excessive - the foodservice operator does not have this luxury. The foodservice customer expects lettuce on the Big Mac regardless of the price of lettuce in the market. By processing and packaging the fresh product, suppliers are able to reduce the price risks associated with bulk fresh produce. (Packer, February 13, 1993)

Food Processing

Food processing is a practical application of the broader field of food science. Food science is generally accepted to be the study of food/systems beyond the agricultural production function. Modern food processing systems incorporate multiple disciplines to yield a singular applied science. The fields of Engineering, Marketing, Economics, Chemistry, Microbiology and Nutrition are all represented in the structural and human

resource requirements of the food processing system. (Jelen, 1985)

Most agricultural products require some post harvest processing to be suitable for human consumption. Understanding the structure of the food processing industry yields insight into the scope and function of each type of processor:

- 1) Primary Processors: convert primary agricultural products to a manufactured, potentially consumable product. Examples: meat slaughterhouses, flour mills, soybean oil processors, washing and packing vegetables.
 - 2) Secondary Processors: convert products from primary processors into readily consumable foods with relatively short shelf life. Examples: Bakeries, Cheese manufacturers and wineries.
 - 3) Tertiary Processors: Transform primary or secondary food materials into shelf stable convenience foods such as frozen dinners, canned stew and instant coffee.
- (Jelen, 1985)

At each level in the processing system the manufacturing function is combined with some element of preservation to add value to the food product. The food processing industry has a dual role in the food system as a whole: 1. "to manufacture edible food items from mostly inedible agricultural products; and 2. to preserve the oversupply of agricultural products available

at the time of harvest for consumption later in the year."

(Jelen, 1985)

The manufacturing and preservation functions of the processor is generally achieved in conjunction with a packaging system. The package functions of containing, carrying, dispensing and preserving are the more obvious functions employed in the food processing system. (Hanlon, 1984) Food packaging systems are used to protect food from deterioration as a result of biochemical, enzymatic, and microbiological activity, and physical hazards. (Bakker, 1986)

Vegetable Processing

Most commercial vegetable processors are classified as secondary processors, and employ one of eight general methods:

- 1) Canning (Heat Processing)
- 2) Freezing
- 3) Concentration
- 4) Refrigeration
- 5) Dehydration
- 6) Freeze Drying
- 7) Pickling and Fermenting
- 8) Radiation Preservation

(Luh & Woodruff, 1988)

Heat processing is based on the premise that most microorganisms are destroyed when exposed to lethal temperatures (generally 49 degrees celsius and higher). Subsequent to heat destruction of microorganisms the packaging system is depended upon to prevent recontamination. In essence, the food product is place inside a glass or metal container (or flexible pouch), the air is removed by vacuum and the container is hermetically sealed. Once sealed, the containers are placed in a retort and sterilized with steam. The rate of heat penetration into the food product is of principal concern - since this process destroys food enzymes and microorganisms. Heat transfer is generally achieved by means of convection, conduction or some combination of the two. (Luh & Woodruff, 1988)

Freezing alone can destroy up to 90% of the bacteria in some foods and, will slow most enzymatic activity. It is not a sufficient means of destroying all bacteria or completely arresting enzymatic activity. Therefore, freezing processes are generally preceded by a blanching process to stop respiratory and oxidative enzymatic activity. (Hanson, 1975) There are a variety of freezing methods available to commercial processors. These methods include; individual quick freezing, freezing in the container and immersion freezing. Each of these methods will employ one of six freezing processes. These freezing processes are: 1) Blast freezing 2) Plate freezing 3) Belt tunnel freezing 4) Fluidized bed freezing 5) Cryogenic freezing, and

6) Dehydrofreezing. The selection of which process to use will depend on the processor's capital limitations and type of vegetable being processed. (Luh & Woodruff, 1988)

The vegetable concentrate industry has grown at a substantial rate relative to other commercial processes. The favorable economics associated with concentrates have undoubtedly contributed to this growth. The removal of water weight and reduction of volume allow for reduced transportation and distribution costs. (Nelson & Tressler, 1980)

Concentration processes include 1) freezing and mechanical separation 2) low-temperature vacuum evaporation and, 3) high-speed high-temperature evaporation. Each of the three methods possess distinct advantages and disadvantages. The freezing process reduces the amount of volatile flavor substances, (a major disadvantage of evaporation processes) but substantial percentages of soluble solids are lost in the ice. High temperature evaporators are utilized to inactivate certain enzymes, prevent clarification and gelation in the concentrate. The heat process has a particularly negative effect on color and texture in some vegetable concentrates. (Luh & York, 1988)

Dehydration is one of the oldest food preservation methods, and is still widely utilized. The process attempts to reduce the water activity in the food products, in-turn inhibiting bacterial

growth. Prior to dehydration most vegetables are prepared by means of blanching and treatment in some preservative solution. The most widely used solutions have been sulfites. (Luh & York, 1988) In general, one of the following methods (or a combination of methods) will be used to dehydrate vegetable products: 1) forced air drying, 2) vacuum drying 3) freeze drying 4) spray drying, 5) drum drying 6) reverse osmosis, and, 7) dehydration with nitrous oxide method is frequently done in conjunction with vacuum drying. (Hanson, 1975) Successful dehydration will not only result in reduced water activity and microbial growth, but also successful rehydration of the product to near its original form. (Luh & York, 1988)

Pickling and fermentation processes depend on the reduction of pH levels in a surrounding liquid environment to preserve food. Preservation is achieved by acidification and storage in an acidified brine. The packaging system is depended upon to prevent any mechanical or biological contamination by means of storage in a hermetically sealed container. (Luh & York, 1988)

Radiation preservation has not been widely implemented in U.S. food processing systems. Consumer concerns over residual radiation have hampered both commercial acceptance and regulatory approval of irradiated vegetables. (Nielsen, 1987) In addition to consumer based concerns, irradiation has had negative effects on flavor and vitamin content of some fresh vegetables (Luh &

York, 1988)

Refrigerated preservation and processing techniques are central to the fresh processing method and will be presented in detail in the next section.

Fresh Vegetable Processing and Storage Systems

Determinants of fresh vegetable quality are largely based on sensory criteria. The four basic characteristics of vegetable quality are: 1) color or eye appeal, 2) odor and flavor, 3) texture and, 4) nutritive value. (Sulunhhe & Desai, 1988) It is widely accepted that sensory evaluation yields insight into the biological quality of the product. Nutritive evaluation of vegetables gives consideration to the chemical components of the food, and depends less on the human senses. It is important to consider issues of food quality going beyond what is detectable by the human eye and olfactory. Much of the recent literature proposes a systems approach to food/vegetable quality; integrating microbiological, chemical adulterants and other toxins in the quality criteria. (Wolf, 1992)

Microbial growth, in addition to plant physiology, are principle contributors to overall degradation of vegetable quality (as determined by organoleptic criteria). (Jelen, 1985) The prevention of microbiological hazards is a principle function

of the food packaging system. Evaluation of the package system must consider its effectiveness in preventing microbial growth and the associated effects on the sensory aspects of food quality. (Bakker, 1986) The preservation of nutritive value is a function of both the package and storage systems. In general, the inhibition of microbial growth will, in turn, prevent the degradation of nutritive value. However, other environmental factors such as temperature, atmosphere, and humidity must be rigorously controlled to prevent the break down of vital nutrients common in fresh vegetables.

The interaction between minimally processed vegetable product, packaging system, storage system and distribution system has been researched and attempts have been made to integrate each system into a more holistic and inclusive approach. A model proposed by Theodore Lioutas (Food Technology, September 1988) outlines a totally integrated food chain utilizing controlled and modified atmosphere packaging technology. The food chain model is based on four cycles, each with specific objectives. The four cycles of the food chain model are:

1. Post-harvest Cycle
2. Processing Cycles
3. Post-processing Cycle
4. Retail Cycle

(Lioutas, 1988)

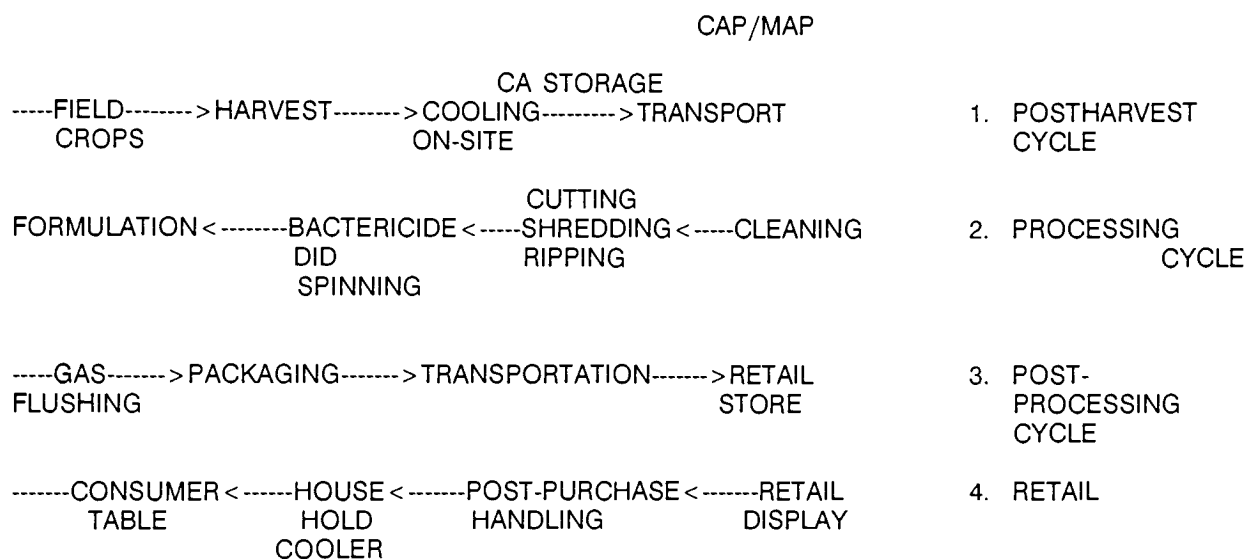
In addition to identifying and integrating specific objectives,

the food chain concept allows for integration of critical control points in establishing an effective Hazard Analysis and Critical Control Point (HACCP) system. The food chain model is outlined in Figure 1.1.

Figure 1.1

Totally Integrated Food Chain

Source: T. Lioutas, Food Technology, September, 1988.



Traditional models of the processing system have been less inclusive, seldom incorporating the customer or the post-processing cycle into the model. Figure 1.2 outlines a more traditional model focussing on the processing system. This model fails to recognize factors influencing product quality in either the pre-processing or post-processing phases. It is not uncommon, however, for processors to envision their processing environment with equally limited scope. It is this limited perspective contributing to much of the quality problems facing

fresh vegetable processors. (Kader, et al. 1987)

Figure 1.2

Traditional Food Processing Model

For Minimal Processing of Cabbage

Source: K. Lovell, CMI Engineering, 1991

RAW PRODUCT RECEIVED-----> STORAGE COOLER-----> DUMP HOPPER
33° - 38° 33° 35°

FLUME <----- INSPECTION <----- DICING OR <----- CLEANING &
HOPPER BELT SHREDDING CORING

FLUME SYSTEM-----> SHAKER-----> SPIN-----> PACKAGING
33°- 35° CHLORINATED SCREEN DRYERS SYSTEM
WATER

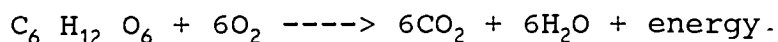
Product/Package Considerations in the Post Harvest Cycle

A fundamental, but exceedingly important consideration in the postharvest handling of fresh produce, is the fact that harvested fruits and vegetables are "living" entities. The metabolic activity associated with postharvest physiology is a continuance of the cellular activity that occurred while the produce was still rooted or attached to the tree or vine.

An important dimension of all plants is that they respire by taking up oxygen (O_2), and giving off carbon dioxide (CO_2) and heat. Plants also lose water (transpire). The loss of water by transpiration, and oxidation resulting from respiration, is

normally balanced by the flow of sap and photosynthates to the produce while rooted or attached to the plant. Harvesting separates the produce from the plant and its source of water and photosynthetic nutrients. The produce begins to deteriorate immediately after harvest. (Wills, McGlasson et al. 1989)

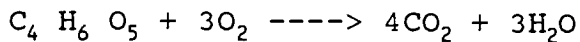
Respiration is the oxidative breakdown of complex cellular materials into simpler molecules. Specifically, in produce, the complex starches, sugars and organic acids are broken down into carbon dioxide, water and energy, as well as some hormones. Respiration can occur in the presence of oxygen and is known as aerobic respiration. Respiration may also occur in the absence of oxygen and is known as anaerobic respiration or fermentation. (Wills, et al. 1989) Most of the energy requirements of fresh produce are supplied by aerobic respiration. The normal substrate for respiration is glucose; complete oxidation is reflected by the following reaction:



This reaction is essentially the reverse of photosynthesis. In photosynthesis the energy source is the sun. The energy derived from the sun is stored as chemical energy in carbohydrates composed of glucose. (Jelen, 1985)

It is important to note that as glucose reserves are depleted other oxidizable substrates will be metabolized. The oxidation of organic acids produces a proportionately higher

amount of carbon dioxide per amount of consumed oxygen. The reaction below reflects the complete oxidization of malate:



Unlike the oxidization of glucose, this reaction does not generate equal amounts of carbon dioxide per oxygen consumed. More carbon dioxide is produced as the cell converts simpler molecules to energy. (Wills, et al. 1989) The ratio of carbon dioxide produced per oxygen consumed is known as the respiratory quotient (RQ). This quotient is measured on a range from .7 to 1.3 depending upon the substrate being oxidized*. (Zagory & Kader, 1988) In the malate reaction the RQ = 1.3, for substrates such as fatty acids the RQ = .7. (Wills, et al. 1989)

The respiratory quotient is an important factor to consider when the respiring product is placed in an enclosed environment, such as a package or storage facility. Controlled atmosphere technology is frequently employed to create the optimal balance of carbon dioxide and oxygen in the package or facility. Respiration rates are sensitive to atmospheric concentrations of oxygen and carbon dioxide. The ambient concentration of oxygen is normally twenty one percent (21%). The application of modified or controlled atmosphere processes may reduce the package environment to as little as 2-5% oxygen. Respiratory *RQ

CO₂ produced (mL)/O₂ consumed (mL) (Wills et al. 1989)

rates are sensitive to concentrations in the 8-10% range.

(Zagory & Kader, 1988)

The reduction of oxygen in the package environment results in a reduction in the respiration rate of the produce. The rate of oxygen consumption is commodity specific. The corresponding optimal concentration of oxygen is also commodity specific. As oxygen levels are reduced the RQ is changed and higher levels of carbon dioxide accumulate in the package/storage environment. The commodity's carbon dioxide tolerance will determine at what point anaerobic respiration dominates the cell's metabolic activity. (Wills et al. 1989)

Anaerobic respiration converts glucose to pyruvate which is further metabolized to either lactic acid or acetaldehyde and ethanol. The point at which oxygen depletion causes anaerobic respiration to replace aerobic respiration, is known as the extinction point. The extinction point is dependent upon several factors, such as: 1) species 2) cultivar 3) maturity 4) temperature. (Wills, et al.)

As the fresh vegetable moves from the post-harvest cycle to the processing and post processing cycles; the rate and nature of respiration will continue to influence how the product is handled. The delivery of high quality, minimally processed fresh vegetables to the end user, is dependent on the effective

management of cellular activity associated with respiration.
(Lioutas, 1988)

Factors in Packaging, and Distribution of Fresh Produce

The successful packaging, processing and transportation of fresh vegetables is dependent on the interface between commodity specific factors and package/storage environment factors.

Zagory and Kader outline six commodity factors and three environmental factors which warrant consideration in the packaging of fresh produce:

Commodity Factors

1. The commodity's resistance to the diffusion of oxygen, carbon dioxide and ethylene.
2. The rate of respiration and commodity's sensitivity to changes in oxygen concentration.
3. The commodity's production and sensitivity to ethylene. In general reduction of oxygen and increased carbon dioxide result in reduced ethylene production. Ethylene causes rapid ripening and increased respiration rates in some produce.
4. The optimal storage temperature of the product. Most produce benefits from low temperatures of 2-5 degrees Fahrenheit above freezing. Each commodity has an ideal temperature at which senescence is delayed and respiration slowed.

5. The optimal relative humidity of the produce item is especially critical in affecting the transpiration rate. Low relative humidity can increase the rate at which the cells lose water and become dehydrated. Excessive relative humidity contributes to moisture build up in the package and on the product. The collection of moisture creates conditions suitable for microbial growth.
6. The optimal concentrations of carbon dioxide and oxygen for the commodity in storage. This is related directly to the tolerance and physiological responses to carbon dioxide and oxygen.

(Kader et al. 1988) (Zagory and Kader, 1988)

Environmental Factors

1. Ambient temperature and relative humidity effect the commodity by transfer through or across the package material. In flexible films, temperature changes the gas permeability of the film. Condensation build-up can compromise the vapor barrier characteristics of some films.
2. The presence of light causes degradation and premature ripening in some commodities. The presence of ambient light may accelerate the respiration rate of green vegetables by stimulating photosynthetic actions.
3. Sanitation factors must be considered throughout the

processing, packaging and storage of fresh produce.

The interplay between humidity, low oxygen levels and temperature create potential conditions for bacterial growth. (Zagory and Kader, 1988)

The following charts present commodity specific environmental considerations. Table 1.4 presents groups of produce compatible by temperature and relative humidity. This data is relevant when considering mixed truck loads, and storage of produce in long or short term refrigerated storage.

Table 1.5 presents a list of ethylene sensitive and ethylene producing fruits and vegetables. The storage or transportation of ethylene sensitive products with ethylene producing products may result in premature ripening or compromised quality.

The transfer of odor from one commodity to another is an additional consideration in the transportation/storage of bulk and packaged produce. Most polymers will prevent the transfer of odors in packaged/processed produce. If odor sensitive products are stored for extended periods of time, the transfer of odor through the film may occur if environmental conditions (relative humidity) allow. (Kader, 1985) Table 1.6 presents a series of odorous commodities along with incompatible (odor sensitive) products.

The delivery of high quality fresh bulk and processed produce is a delicate balance between commodity and environmental factors. The single most important factor is the control of ambient temperature. Temperature influences respiration and the rate of senescence. It is the critical factor in delivering safe processed produce throughout the food chain. (Lioutas, 1988)

Table 1.4
In-Transit Environment
Load Compatibility Groups

Group I	Temperature: 32-36 Degrees Fahrenheit		Relative Humidity: 90-95%	
Apples	Horseradish	Nectarine	Plums	
Apricots	Kohlrabi	Oranges(FL & TX)	Prunes	
Berries	Leeks	Parsnips	Radishes	
Cherries	Lychees	Peaches	Rutabagas	
Grapes	Mushrooms	Pears	Turnips	
Group II	Temperature: 32-36 Degrees Fahrenheit		Relative Humidity: 95-100%	
Asparagus	Bok Choy	Celery	Kiwi	
Bean Sprouts	Broccoli	Cauliflower	Lettuce	
Beets	Brussels Sprouts	Sweet Corn	Parsley	
Belgian Endive	Cabbage	Daikon	Peas	
Berries	Carrots	Grapes	Rhubarb	
Snow Peas	Spinach	Watercress		
Group III	Temperature: 32-36 Degrees Fahrenheit		Relative Humidity 65-75%	
Garlic	Dry Onions			
Group IV	Temperature: 40 Degrees Fahrenheit		Relative Humidity 90-95%	
Cactus Pears	Melons			
Cantaloupe	Tamarillos			
Cranberries	Tangelos			
Lemons	Tangerines			
Oranges (CA & AZ)				
Group V	Temperature: 50 Degrees Fahrenheit		Relative Humidity: 85-90%	
Beans	Okra	Soft Shell Squashes		
Cucumbers	Peppers	Tamarindos		
Egg Plant	Storage Potatoes	Taro Root		
Group VI	Temperature: 55-60 Degrees Fahrenheit		Relative Humidity: 85-90%	
Avocados	Cherimoyas	Guavas	Papayas	Pumpkins
Bananas	Coconuts	Lemons	Melons	Hard Shell Squash
Breadfruit	Ginger Root	Limes	Pineapples	Ripe Tomatoes
Carambolas	Grapefruit	Mangoes	New Potatoes	
Group VII	Temperature: 65-70 Degrees Fahrenheit		Relative Humidity: 85-90%	
Jicama	Tomatoes (mature greens)			
Pears (ripening)	Watermelon			
Sweet Potatoes	Yams			

Source: The Packer; "1992 Produce Transportation Guide"

Table 1.5
Ethylene Sensitive and Ethylene Producing Fruits and Vegetables

Ethylene Sensitive

Unripe Bananas	Chard	Peas
Green Beans	Cucumbers	Peppers
Belgian Endive	Eggplant	Spinach
Broccoli	Unripe Kiwi	Squash
Brussels Sprouts	Leafy Greens	Sweet Potatoes
Cabbage	Lettuce	Watercress
Carrots	Okra	Watermelon
Cauliflower	Parsley	

Ethylene Producing

Apples	Honeydew	Plantains
Apricots	Mangoes	Plums
Avocados	Nectarine	Prunes
Bananas (ripening)	Papayas	Quince
Cantaloupe	Passion Fruit	Tomatoes
Cherimoyas	Peaches	
Figs	Pears	
Guavas	Persimmons	

Source: The Packer; "1992 Produce Transportation Guide"

Table 1.6
Commodity Specific Odor Transfer

Odor Produced By:

1. Apples
2. Avocados
3. Carrots
4. Citrus
5. Ginger Root
6. Grapes (treated with sulfur dioxide)
7. Onions
8. Green Onions
9. Pears
10. Potatoes
11. Peppers

Will Be Absorbed By:

- Cabbage, Carrots, Celery, Figs, Onions, and Animal Products (Meat, Dairy, Eggs)
- Pineapples
- Celery
- Animal Products (Meat, Dairy, Eggs)
- Eggplant
- Many other Fruits and Vegetables
- Apples, Celery, Pears
- Corn, Figs, Grapes, Mushrooms, Rhubarb
- Cabbage, Carrots, Celery, Onions
- Apples, Pears
- Pineapples

Source: The Packer; "1992 Produce Transportation Guide"

Fresh Produce Sanitation and Safety

A 1990 survey of federal agency food safety concerns found the agencies were most concerned with the microbiological safety of the United States food supply. The survey results were clustered in three categories: 1)Microbiological 2)Residues 3)New Products and Processes. The agency by agency list of concerns is presented in table 1.7. A review of table 1.7

reflects a number of concerns directly related to the microbial or process integrity of minimally processed fresh vegetables.

A review of the literature suggests there are three areas of concern in the safety of respiring processed vegetables; 1) emergence of new pathogens capable of growing under refrigeration, 2) reduction/elimination of microflora associated with minimally processed products, 3) activation of anaerobic bacteria resulting from the modification of package atmospheres. (Lioutas, 1988) (Zagory and Kader, 1988) (Jelen, 1985)

The "new" pathogens of critical concern include *Listeria monocytogenes*, *Aeromonas hydrophilia*, *Clostridium botulinum*, *Bacillus cereus*, *Yersinia enterocolitica*, *Vibrio parahaemolyticus* and *Staphylococcus aureus*. The fundamental safety issues are associated with the ability of these pathogens to multiply at relatively low temperatures. (Lioutas, 1988)

Table 1.7

Food Safety Concerns of Federal Agencies

1. Food & Drug Administration (Center for Food Safety and Applied Nutrition)
 - Foods produced by biotechnology and other novel means
 - Microbial safety of foods, including the implications of more sensitive pathogen detection
 - Programs for monitoring the safety of the food supply
 - Consumer education about food safety and food label information
2. FDA (Center for Veterinary Medicine)
 - Mycotoxin contamination of feedstuffs
 - Pesticides and industrial contamination in feeds
 - Microbial contamination of feeds
 - Feed and drug products produced by biotechnology
 - Industrial wastes used as feed ingredients

3. Centers for Disease Control
 - Emerging pathogens, drug resistant pathogens, new food vehicles for pathogen transmission
 - Spread of animal pathogens by greater interstate and international movement of animals
 - Rapid interstate and international distribution of perishable foods eaten without further processing
 - Increased use of antibiotics and the antimicrobial resistance of foodborne pathogens
 - New foods and new methods of food preparation and storage
4. U.S. Department of Commerce (National Marine Fisheries Service)
 - Pollutants and contaminants
 - Biotoxins in fin fish and molluscan shellfish
 - Cleansing of contaminated molluscan shellfish
 - Potential hazards associated with new processing, packaging and marketing techniques
 - Decomposition indicators
 - Seafood inspection
5. U.S.D.A Food Safety and Inspection Service
 - Foodborne pathogens - bacteria and viruses
 - Chemical residues - drugs, residues, environmental contaminants
 - Modernization of meat and poultry inspection
6. U.S.D.A. Federal Grain Inspection Service
 - Preventing mycotoxin and pesticide residue contamination
 - Retraining current workforce to use new technology
7. U.S.D.A Agricultural Marketing Service
 - Microbial contamination
 - Residues
 - Biotechnology
 - Voluntary pesticide residue testing
 - International harmonization of food regulations
 - Nutritional content of food
 - Growth hormones in animal foods
 - Food irradiation
8. U.S.D.A. Agricultural Research Service
 - Control methods for salmonella and campylobacter in meat and poultry
 - Control methods for hazardous bacteria in meat and vegetable products
 - Tests to detect and reduce chemical pesticide use
 - Control of aflatoxin and other mycotoxins in crops
9. U.S.D.A Animal and Plant Health Inspection Service
 - Microbial contamination of foods
 - Food risk communication
 - More reliable tests for monitoring microbial and chemical contamination of foods
 - Ante and post-mortem food inspection for additional species of animals

The pathogens most directly associated with vegetables and vegetable processing are *clostridium perfringens*, *clostridium botulinum* and *listeria monocytogens*. *Salmonella* has also been identified as a common pathogen associated with vegetables. However, the favorable growth temperature of ninety nine degrees fahrenheit does not constitute a primary threat in refrigerated storage. The *listeria monocytogens* and *clostridium perfringens* have recorded lower temperature growth. The *listeria* is known to

multiply at temperatures between 45-49 degrees fahrenheit. New strains of clostridium perfringens have demonstrated ability to multiply at temperatures below fifty degrees fahrenheit.

(Troller, 1983) (Hooper, 1989) The ability of these pathogens to sustain growth at lower temperatures, places additional pressure on the distribution system. Control of the storage/distribution temperature must be maintained to guarantee the delivery of safe refrigerated foods to the end user.

Minimally processed products frequently take advantage of controlled or modified atmosphere technology in the packaging process. As previously discussed, the reduction of oxygen in the packaging environment slows the respiratory rate of most respiring products. By reducing the oxygen content of the package the growth of aerobic bacteria, which normally spoil the product, is greatly inhibited. Anaerobic bacteria, if present, begin to thrive in environments low in oxygen. The anaerobic nonproteolytic toxin producing bacteria no longer are forced to compete with aerobes for environmental nutrients. Generally, the anaerobic organisms will cause no organoleptic degradation. The product will appear unspoiled with little noticeable off smell or taste. This could lead to the delivery of hazardous or poisoned food to the end user. (Troller, 1983) (Saguy, 1992)

The initial microbial load is a critical factor in the microbial quality of the finished minimally processed vegetable.

A number of control points have been proposed to guarantee high quality finished product. These control points include: 1) the use of food with high organoleptic quality, 2) employ sanitary washes in pre-processing and in the flume system, 3) establish tight temperature control throughout the whole system. (Lioutas, 1988)

Product Constraints on Packaging Material Selection

The management of respiratory off-gases is one of the fundamental concerns in the selection of packaging materials for minimally processed vegetables. The ideal films allow for diffusion of carbon dioxide and oxygen across the film barrier. The goal is to create a "breathing" package which helps to maintain the optimal levels of both carbon dioxide and oxygen. To avoid anaerobic conditions the film's permeability must allow enough oxygen to pass through to the product. The carbon dioxide permeability must allow carbon dioxide to be vented while still maintaining an optimal level in the package environment. Because the respiratory quotient is generally one to one, and is tipped in favor of accelerated carbon dioxide under prolonged storage or compromised temperature conditions, the ideal film will allow proportionately more carbon dioxide to exit than oxygen to enter the package. (Zagory and Kader, 1988)

There are relatively few films which have O_2/CO_2 permeabilities which make them acceptable for packaging of

respiring products. The most commonly used films and the corresponding gas permeabilities are presented in table 1.8.

Table 1.8

Selected Permeabilities of Films Used in Fresh Vegetable Packaging

Film Type	Permeabilities (CL/M2/mil/day at/atm)		
	CO ₂	O ₂	CO ₂ /O ₂ Ratio
LDPE	7,700-77,000	3,900-13,000	2.0 - 5.9
PVC	4,263-8,138	620-2,248	3.6 - 6.9
PP	7,700-21,000	1,300-6,400	3.3 - 5.9
Polystyrene	10,000-26,000	2,600-7,700	3.4 - 3.8
Saran	52-150	8-26	5.8 - 6.5
Polyester	180-390	52-130	3.0 - 3.5

Source: Zagory and Kader, 1988.

The low permeability of both Saran and polyester make these films suitable only for vegetables with very low respiratory rates. The most widely used films are low density polyethylene and polyvinyl chloride. (Zagory and Kader, 1988)

In addition to the factors associated with respiration rates, the selection of packaging materials must also consider the effects of transpiration. Once again the goal is to select materials which have moisture vapor transmission rates (MVTR) suitable to the packaged commodity. In general, the ideal ambient relative humidity reflects the optimal package environment moisture. (Lioutas, 1988) Unfortunately, there is very little in the literature indicating the effect of high ambient relative humidity on MVTR. A number of recent studies have focussed on the impact of high ambient relative humidity on

oxygen transmission rates. It is generally presented that high relative humidity can inhibit the overall effectiveness of films and their MVTR. (Pike, 1989) An exhaustive review of the literature found no research which correlated the optimal ambient relative humidity for a specific commodity, the transpiration rate of a given commodity and impact of these conditions/criteria on the MVTR, and selection of a specific film.

The body of this literature review reflects a diverse group of topics. An attempt has been made to establish linkages between the end-user group identified in this study; the general products of interest, and the storage, distribution and packaging system associated with the flow of these products to the end user.

Chapter III

Methodology and Research Design

The review of literature focussed on establishing the relevance of the study within the context of four broad themes.

The four themes:

- 1) Transition and reconfiguration of the food system:
Focus on foodservice.
- 2) Food product quality and packaging issues for minimal processing of fresh produce.
- 3) Systemic approaches to minimal processing.
- 4) Customer focussed approaches to packaging for minimal processors of fresh produce.

The focus of the present chapter addresses the methodology employed during the research phase. The research design consists of four distinct components:

- 1) Subjective assessment of criteria to be measured by the survey instrument
- 2) Construction of the research instrument
- 3) Sampling procedures and administration of the survey instrument
- 4) Application of statistical measures to collected data

Subjective Assessment of Survey Design

A focus group of industry representatives was queried relative to the draft of the survey instrument. This was done to insure the collection of data on relevant product and package criteria. The panel consisted of ten (10) individuals (see appendices) from various sectors of the food industry.

Subjective input was solicited on the factors which most frequently affected the group's purchasing decisions. The group was also polled on their understanding of the terminology and phrasing employed on the survey instrument and general understanding of the questions.

Further insight was sought from the research sponsor. The collection of relevant data was the principal goal of the focus group.

Construction of Research Instrument

The research instrument (survey) consisted of a total of eleven (11) questions requiring fifty three (53) responses. The questions were positioned within five broad categories. The questions within each of the categories were a combination "yes/no", ranking, subjective and self classification questions.

The questions were grouped into the following categories:

1. Foodservice Market Segment Self Classification Questions
2. Fresh Product Questions
3. Minimally Processed Product Questions
4. Minimally Processed Product Purchasing Criteria Questions
5. Minimally Processed Package Criteria Questions

Foodservice market segment data was sought in question one and question two. Question one sought to establish the annual sales volume of potential users of both fresh and minimally processed produce items. Sales volume is a good indicator of the size of a foodservice operation and may be used to segment the market.

Question two addresses generally accepted market segments for most foodservice operations. The segments utilized on the survey have been identified by the International Foodservice Manufacturers Association. (IFMA) (Data Digest, 1991)

Question three sought geographic data from respondents; "City," "State" and "Zip Code" data was requested. The fourth response (question#1) on the survey begins to solicit product specific information. The fresh produce items were of interest to the research sponsor; 1) Fresh whole cabbage, 2) Fresh whole

carrots, 3) Fresh minimally processed cabbage, 4) Fresh minimally processed carrots. The fourth question (question #1) on the survey is a yes/no question seeking to establish whether respondents were use users of the processed cabbage product.

The fifth question seeks to establish unit size and price per unit cost for the users of the processed cabbage product.

The sixth question seeks to establish how the minimally processed cabbage product is utilized by foodservice operators. The respondents are queried relative to their use of five popular applications of the product and given a sixth "other" category.

The seventh question sought to establish the volume of the product used by the respondent. This has further market segmentation and potential package design implications.

The eighth question seeks to establish the use of the fresh whole cabbage product. This is done via a "yes/no" response question.

The ninth question sought data on the type of standardized units purchased by foodservice operators.

The tenth question sought to establish the respondents satisfaction or dissatisfaction with the unit being purchased.

The eleventh question seeks subjective input relative to the response to the tenth question.

Questions 4c, 4d, 4e, the twelfth, thirteenth and fourteenth responses respectively; seek information relative to the form, price and unit of fresh product being purchased.

Question number 5, the thirteenth response, seeks to establish intended use of the whole fresh product. Similar, in its intent, to question number 2 (the sixth response).

The fourteenth response (question number 6) seeks to establish the volume of fresh product used.

Question number 7 begins questions dedicated to the minimally processed fresh carrot products. Question number 7 seeks to determine the use of any form of the product. Question 7a attempts to address common forms of the carrot product.

Questions number 8 and 9 seek to establish the intended foodservice application of the product and the volume of use.

Question 10 begins importance performance ranking questions. Question 10 (a) through 10 (0) seek to establish the level of importance each respondent assigned to specific product criteria. The criteria were assigned the importance ranks of "Extremely",

"Very Important", "Important", "Somewhat Important", "Not Important." The product criteria identified by the focus group were of principal concern.

Questions 11(a) through 11(p) represent the fifth broad category, which seeks packaging criteria information. These questions were designed to establish the level of importance each respondent assigned to minimally processed vegetable packaging criteria. This question is similar in design to question 10. Package specific criteria is presented to the respondent with important performance rankings of "Extremely", "Very Important", "Somewhat Important", and "Not Important" assigned. Question 12 seeks general subjective information from the respondents. The question is designed to solicit information not otherwise included in the survey.

Sampling Procedures and Administration of the Survey Instrument

Respondents were selected from a mailing list generated by Restaurant Business magazine. Survey candidates were selected based upon the market segment the company served.

The respondents can be separated into two broad classifications of foodservice operations. A total of 600 commercial foodservice operators and 600 non-commercial operators were selected. The two broad classifications (commercial and

non-commercial) were further isolated by market segment served. The composition of the final list of survey candidates consisted of the following number of commercial and non-commercial operations.

<u>Commercial</u>		<u>Non-Commercial</u>	
<u>Segment</u>	<u>No. of Candidates</u>	<u>Segment</u>	<u>No. of Candidates</u>
Carry-out/Deli	125	Business & Industry	150
Fast Food	125	Hospital/Nursing	
Full Service	125	Facility	150
Cafeteria	125	Education	150
Lodging	<u>125</u>	(College/University &	
Total	600	Primary/Secondary)	
		Military	<u>150</u>
		Total	600

A total of 1200 candidates were administered surveys. The candidates were selected randomly from the Restaurant Business data base. Geographic location was the only additional limiting criteria. Respondents were sought from all fifty of the United States. The relatively small number of candidates within each of the segments, would not allow for each segment to be representative of all fifty states. The complete list of 1200

candidates is geographically representative of all 50 states, the District of Columbia, Guam, Puerto Rico and the U.S. Virgin Islands.

The utilization of a commercial data base to generate the list of candidates forces the researcher to accept a less than 100% response rate. The mailing lists are not 100% accurate which greatly diminishes the response rate. (Quinney, 1992). A target response rate of 10% was established at the time of mailing.

Application of Statistical Measures

All data generated from the surveys was analyzed in an attempt to establish the packaging and product criteria of greatest importance to foodservice operators. The SPSS-X program was employed to analyze the data utilizing three primary statistical methodologies.

The first analysis is largely descriptive analysis of response rates across market segments, geographic parameters and specific descriptive questions on the survey. Analysis of central tendency and dispersion was of principal concern.

The second analysis consisted of crosstabulation of descriptive questions with questions associated with purchasing

criteria. The crosstab analysis was performed to establish a profile of the packaging purchasing criteria preferred by foodservice operators.

Third, factor analysis was performed via SPSS-X to determine any underlying constructs associated with the primary data analysis. The orthogonal factor matrix performed on the data yields insight into other potential constructs of interest.

Chapter IV

Data Analysis and Findings

The following chapter will review the statistical interpretation of the data. The principal focus is on packaging and product purchasing criteria. Not all of the data generated from the survey is presented in this chapter or in the body of this thesis. The data of concern is the data which is central to the hypothesis of this study.

All of the statistical analysis presented in this study was performed on the RITVAX system at Rochester Institute of Technology. The analysis of the data was conducted by employing three statistical procedures:

- 1) Descriptive statistics including analysis of means and standard deviation.
- 2) Crosstabulation analysis of product and package purchasing criteria with market segment data.
- 3) Factor analysis to identify underlying constructs.

Response Rates and Determination of Sample Size

A total of 1200 surveys were mailed in March of 1992. (See Appendix) A total of sixty surveys were returned due to address inaccuracy or the discontinuation of business by the addressee.

This reduces the total number of potential respondents to 1140.
A total of 160 surveys were returned and considered valid.

The sample size of 160 represents a 14% response rate. This was considered to be a representative sample. A target response rate of 10% had been established, the 14% response achieved was determined to be acceptable.

Respondent Descriptive Data

Annual Sales Volume and Market Segment Data

The first two questions on the survey sought to establish the annual sales volume of the respondent and the market segment served by the respondent. The "Annual Sale Volume" data is summarized in table 2.0.

Table 2.0

Annual Sales Volume

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
\$100,000-299,999	1	21	13.1	13.6	13.6
\$300,000-399,999	2	12	7.5	7.8	21.4
\$400,000-499,999	3	21	13.1	13.6	35.1
\$500,000-599,999	4	4	2.5	2.6	37.7
\$600,000-799,999	5	18	11.3	11.7	49.4
\$800,000-999,999	6	9	5.6	5.8	55.2
\$1MIL-1,999,999	7	31	19.4	20.1	75.3
\$2MIL-2,999,999	8	10	6.3	6.5	81.8
\$3MIL-3,999,999	9	8	5.0	5.2	87.0
\$5MIL-5,999,999	11	7	4.4	4.5	91.6
OVER 6 MIL	12	13	8.1	8.4	100.0
		<u>6</u>	<u>3.8</u>	<u>Missing</u>	
	Total	160	100.0	100.0	

"Annual Sales Volume" data reflects the relative size (in sales volume) of the respondents. The data indicates heavy concentration of respondents in the first three sales volume categories (100,000 - 499,999). A full 35.1% of the respondents are represented in these categories. The mode is reflected in the "\$1 million - \$1,999,999" value. Thirty one respondents, representing 20.1% of the total, had annual sales in this range. The mean value is positioned between category #5 (\$600,000 - 799,999) and #6 (\$800,000 - \$999,999).

The "Type of Operation" data is used to establish the market segment each of the respondents serves. The data reflects significant representation of noncommercial operations. Respondents operating in "Business & Industry" "Hospital & Nursing" and "College and University" segments are representative of 63.9% of all respondents. (see table 2.1) The "Hospital and Nursing" segment was the mode, with 46 respondents representing 28.8% of the total.

The commercial segments were less likely to respond. Only 26.5% of the respondents are considered to be commercial operations. The largest representative commercial segment is the "Full Service" segment with 11.3% of the sample. It is important to note the significant number of commercial operations deleted from the initial pool of 1200. Commercial operations operate in a more volatile economic environment. A large number of the

surveys returned, due to inaccurate address or discontinuation of business by the addressee, were from the commercial market segments.

Table 2.1

Type of Operation

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Fast Food	1	13	8.1	8.2	8.2
Full Service	2	18	11.3	11.4	19.6
Commercial Cafe	3	5	3.1	3.2	22.8
Lodging	4	4	2.5	2.5	25.3
Bus & Industry	5	18	11.3	11.4	36.7
Hospital/Nursing	6	46	28.8	29.1	65.8
College/University	7	38	23.8	24.1	89.9
Deli	8	1	.6	.6	90.5
Primary/Secondary	9	1	.6	.6	91.1
Catering	10	1	.6	.6	91.8
Military	11	13	8.1	8.2	100.0
		<u>2</u>	<u>1.3</u>	<u>Missing</u>	
Total		160	100.0	100.0	

Geographic Description of Data

Table 2.2 summarizes the regional representation of data collected from respondents. As the table demonstrates, the largest number of respondents is from the "Midwest". Midwestern respondents represent 35.0% of all surveys collected. All five domestic (U.S.) geographic regions are represented in the data.

Value	Frequency	Percent	Valid Percent	Cum Percent
1	29	18.1	18.1	18.1
2	30	18.8	18.8	36.9
3	56	35.0	35.0	71.9
4	36	22.5	22.5	94.4
5	9	5.6	5.6	100.0
Total	160	100.0	100.0	

are also representative of all fifty states and the Columbia. The geographic mode is California with 19 representing 11.9% of the total. The six states with presentation are:

19 responses, 11.9%;

11 responses, 6.9%;

9 responses, 5.6%;

8 responses, 5.0%;

8 responses, 5.0%;

8 responses, 5.0%.

Job Title of Respondents

arch instrument sought to determine the management individual completing the survey. This data is determining:

validity of responses

strategic significance of packaging issues within foodservice unit.

Table 2.4 summarizes the data relative to the title of the individual completing the survey. The mode response is associated with title of "Foodservice Director"; fifty four respondents possessed the "Foodservice Director" title.

Table 2.4

<u>Value Label</u>	<u>Value</u>	<u>Frequency</u>	<u>Percent</u>	<u>Valid Percent</u>	<u>Cum Percent</u>
Foodservice Director	1	54	33.8	34.2	34.2
Chef	2	8	5.0	5.1	39.2
Food and Bev. Dir. Manager	3	1	.6	.6	39.9
Purchasing Agent	4	33	20.6	20.9	60.8
Dir. of Purchasing	5	1	.6	.6	61.4
Owner	6	1	.6	.6	62.0
President	7	16	10.0	10.1	72.2
Vice President	8	2	1.3	1.3	73.4
Other	9	1	.6	.6	74.1
	10	41	25.6	25.9	100.0
	.	2	1.3	Missing	
Total		160	100.0	100.0	

The most discomfoting statistic is the high percentage of "other" responses. Manual review of the respondents indicating "other" job titles found most of these respondents were largely from the "Hospital and Nursing" segment. Job titles within this segment do not reflect traditional job titles associated with foodservice operations. The titles within the Hospital and Nursing segment included "Director of Nutritional Care", "Director of Food & Nutrition Services" and "Director of Dietary Care" among others. In general, the surveys were completed by key personnel at the unit or corporate levels.

Minimally Processed Purchasing Data

Data was sought relative to the respondents' use of two common minimally processed vegetable products. The two products of interest were: 1) cabbage 2) carrots. The survey attempts to establish if a minimally processed product is being used by the operation; the form of the product being used; and the volume of usage. The form of the product and weekly volume purchased (in pounds) are of particular concern in establishing package design options.

Product Form and Usage

Forty three of the 160 respondents indicated use of a shredded cabbage mix. The most popular uses of the product were as coleslaw on a salad bar or as a sideorder. Fifty six of the 160 respondents indicated use of minimally processed cabbage in coleslaw as a side order. Forty two of the 160 respondents indicated using shredded cabbage in coleslaw on salad bars. A summary of shredded cabbage mix menu uses is presented in table 2.5.

Table 2.5

Shredded Cabbage Mix Menu Uses

43 Respondents 26.9%

<u>Value Label</u>	<u>Frequency</u>	<u>Percent of Total</u>
Coleslaw Side Order	56*	35.0
Coleslaw Salad Bar	42	26.2
Addition to Salad Mix	17	10.6
Vegetable Side Order	13	8.1
Egg Rolls	1	.6
Other	5	3.1

* The 56 respondents is not consistent with the 43 respondents indicating use of the primary product form.

Fifty eight of the respondents indicated use of a minimally processed carrot product. The most popular forms of minimally processed carrots were "carrot sticks" (44 respondents) and "shredded carrots" (29 respondents). These products were used in a diversity of menu items. The most popular uses were in "salad bar mix" (47 respondents) as "vegetable side order" (36 respondents) and in "stir fry" (32 respondents). A summary of minimally processed carrot form and usage is presented in tables 2.6 and 2.7.

Table 2.6

Minimally Processed Carrot Form Purchased

58 Respondents 36.3%

<u>Value Label Form</u>	<u>Frequency</u>	<u>Percent of Total</u>
Carrot Sticks	44	27.5
Shredded Carrots	29	18.1
Peeled Whole Carrots	13	8.1
Peeled Baby Carrots	9	5.6
Chinese Style	3	1.9
Other	7	4.4

Table 2.7

Minimally Processed Carrot Menu Uses

<u>Value Label</u>	<u>Frequency</u>	<u>Percent of Total</u>
Salad Bar Mix	47	29.4
Vegetable Side Order	36	22.5
Specialty Salads	34	21.3
Stir Fry	32	20.0
Side Salad Mix	30	18.8
Other	20	12.5

Purchasing Volume

The volume of product used over the course of a week is important in establishing the cost and operational significance of minimally processed products within the foodservice operation. The volume, in pounds, also yields insight into potential standard unit and packaging modifications. The relationship between purchase volume, package design requirements and foodservice market segment is discussed in the crosstabular analysis of data presented in this paper.

The more generally descriptive data, relative to the sample is presented in Tables 2.8 and 2.9. Tables 2.8 and 2.9 present a summary of the average volume of product purchased by the survey respondents. Table 2.8 is a summary of the volume of pre-cut cabbage purchased on a weekly basis and Table 2.9 summarizes the volume of minimally processed (pre-cut) carrots purchased each week.

Table 2.8

Pre-cut Cabbage

Purchased Weekly (in Pounds)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
None	1	113	70.6	70.6	70.6
1-50	2	34	21.3	21.3	91.9
20-100	3	4	2.5	2.5	94.4
100-150	4	2	1.3	1.3	95.6
150-200	5	2	1.3	1.3	96.9
200-250	6	1	.6	.6	97.5
250-300	7	2	1.3	1.3	98.8
300-350	8	1	.6	.6	99.4
450-500	11	1	.6	.6	
Total		160	100.0	100.0	

Table 2.9

Minimally Processed Carrots

Purchased Weekly (in Pounds)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
None	1	98	61.3	61.3	61.3
1-50	2	43	26.9	26.9	88.1
50-100	3	8	5.0	5.0	93.1
100-150	4	4	2.5	2.5	95.6
150-200	5	1	.6	.6	96.3
200-250	6	3	1.9	1.9	98.1
350-400	9	1	.6	.6	98.8
450-500	11	1	.6	.6	99.4
OVER 500	12	1	.6	.6	100.0
Total		160	100.0	100.0	

Review of tables 2.8 and 2.9 indicates 70.6% of the respondents were not purchasing the pre-cut cabbage product, while 61.3% were not purchasing a minimally processed carrot product. It is important to note that respondents were asked to evaluate the package criteria regardless if they were purchasing, or not purchasing, the minimally processed product.

Important Performance Ranking of Product and Packaging Criteria

Respondents were asked to rank the importance of specific packaging functions considered in their purchasing criteria for minimally processed vegetables. The respondents ranked fifteen packaging criterion on an importance ranking scale of "Extremely Important", "Very Important", "Important", "Somewhat Important", "Not Important." The fifteen packaging criteria were:

- 1) The use of recycled materials in package.
- 2) The ability of package to control waste of food product.
- 3) Storage efficiency of package.
- 4) The convenience in opening the package.
- 5) The ease or convenience in dispensing product from the package.
- 6) The ability to reseal the package.
- 7) The ability of the package to assist in extending shelf life of product.
- 8) The ability of package to control portion size of product.
- 9) The role of the package in preserving nutritional value of the product.
- 10) The conveyance of storage and preparation information on the package.
- 11) The role of the package in inventory control.
- 12) The cost of packaging.

- 13) The ability of package to meet company specifications.
- 14) The amount of space occupied by package refuse.
- 15) Ability to recycle package.

In addition to packaging criteria respondents were asked to rank overall product criteria on an identical importance rank scale. The product criteria included the following:

- 1) The product's compliance with specification.
- 2) The ease with which the product can be converted for use in recipes.
- 3) The shelf life of the product.
- 4) The color quality of the product.
- 5) The flavor of the product.
- 6) The variety of the produce item
- 7) The agricultural growing region (source) of the product.
- 8) The use of organic growing practices employed in product production.
- 9) The overall product's ability to reduce packaging waste.
- 10) The overall product's ability to reduce food waste.
- 11) The product's inclusion of improved packaging options.
- 12) The level of pesticide residue present in the minimally processed product.
- 13) The nutritional value of the overall product.

14) The cost of the product.

The ranking scale assigned values ranging from one (1) to five (5); with "Extremely Important" corresponding to a value of "one", and a value of 5 corresponding to an importance value of "Not Important." Comparison of mean responses within each of the criteria yields insight into the overall importance assigned to the attribute. Tables 2.10 and 2.11 summarize the mean responses for "Product Performance Criteria" and "Packaging Performance Criteria." The lowest means correspond to the highest rank in importance.

When evaluating the importance of packaging criteria, foodservice operators assigned low importance to source reduction, recycling and closure related criteria. Operators placed a high level of importance on cost and preservation criteria in the purchasing decision. Respondents were consistent in their evaluation of product criteria. Foodservice operators, when evaluating performance criteria of minimally processed vegetables, ranked preservation based quality criteria as high in importance. "Flavor", "Color" and "Cost" all were rated as having high levels of importance in the purchasing decision. The "environmentally friendly" criteria were rated lower in importance. "Reduction of Packaging Waste", "Organic Growing Practices" and "Levels of Pesticide Residue" were all ranked relatively low in importance.

Table 2.10

Performance Criteria	Mean	Skewness	SD
"Cost"	1.901	.664	.882
"Extension of Shelf Life"	2.136	.839	1.097
"Preservation of Nutritional Value"	2.143	.445	.953
"Controlling Product Waste"	2.168	.694	1.080
"Efficiency in Storage"	2.174	.290	.927
"Inventory Control"	2.294	.437	1.057
"Portion Size"	2.542	.592	1.186
"Compliance with Specifications"	2.699	.150	1.136
"Convenience in Dispensing"	2.721	-.005	1.026
"Conveyance of Storage and Prep Info."	2.757	.083	1.139
"Ability to Reseal"	2.791	.130	1.097
"Space Occupied by Package Refuse"	2.849	-.159	1.066
"Convenience in Opening"	2.870	-.118	1.046
"Ability to Recycle Package"	3.169	-.202	1.157
"Use of Recycle Material in Package"	3.221	-.094	1.206

Table 2.11

Performance Criteria	Mean	Skewness	SD
"Flavor"	1.642	.942	.786
"Color"	1.733	.610	.764
"Cost"	1.897	.377	.834
"Reduction of Food Waste"	2.043	.715	.995
"Overall Shelf Life"	2.051	.928	1.124
"Compliance with Specifications"	2.060	.371	.950
"Nutritional Value"	2.160	.263	1.017
"Ease of Conversion to Standardized Recipes"	2.517	.457	1.067
"Levels of Pesticide Residue"	2.534	.272	1.312
"Varietal Traits - Variety"	2.729	.027	1.051
"Reduction of Packaging Waste"	2.840	.027	1.221
"Improved Packaging Options"	3.000	-.427	1.106
"Growing Region"	4.068	-.753	.913
"Organically Grown"	4.316	-1.238	.906

Analysis of Crosstabulation Results

Crosstabulation of packaging criteria importance rank data, with descriptive data associated with operator segment and annual sales volume, was performed on SPSS. The objective of performing crosstabulation is to establish measures of association between variables. In this case, the goal is to associate key package purchasing criteria with specific market segments and operation size based on revenue.

Tables 2.12 to 2.41 reflect the output of the crosstabulating process. The data are presented as frequencies (count), percent of row, percent of the column and percent of the total population. Not all of the data in the crosstab tables are relevant. The crosstabulation revealed only one respondent (to this section of the survey) from each of the following market segments: 1) Deli 2) Primary and Secondary schools 3) Catering operations. When reviewing market segment data, the principle focus is on those segments with a large number of respondents. Attempts will be made to identify unique characteristics of specific segments, and within sales volume ranges.

Crosstabulation Analysis of Importance of Use of Recycled Material in Package

In general respondents were consistent with the population

means presented in 2.10, with a significant percentage of respondents, (50% or greater) within each segment, rating this criteria as only "important", "somewhat important" or "not important." The Fast Food segment had the highest proportion of respondents assigning an "extremely important" or "very important" ranking to this criteria. Fifty percent of the fast food respondents assigned an "extremely" or "very important" ranking to the use of recycled material in the package. Other segments assigning high degrees of importance to this criteria were; Business and Industry (41.2% assigning an importance of "extremely" or "very") and the Military segment (41.7% assigning "extremely" or "very" important). All three of the respondents from the Lodging segment (100% assigned a "not important" rank to this criteria. The other segments are relatively normally distributed with the data skewed to the "not important" ranking.

Operations with smaller annual sales volume were more sensitive to this criteria than operations with larger sales volumes. Forty five percent of respondents with sales volumes ranging \$100,000 to \$299,900 assigned an "extremely" or "very" important ranking to this criteria. Forty one percent (41.7%) of the operators, with sales volume in the \$300,000 to \$399,999 range assigned a rank of "very" important to this criteria. Operators from the remaining sales volume ranges were mostly normally distributed with the data skewed to the "not important" ranking. Respondents from \$500,000 to \$599,999 range were

Table 2.12

Type of Operation by Use of Recycled Material

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	2 16.7 15.4 1.3	4 33.3 12.9 2.6	5 41.7 10.6 3.3	1 8.3 3.0 .7		12 7.9
Full Service	1 5.6 7.7 .7	3 16.7 9.7 2.0	4 22.2 8.5 2.6	5 27.8 15.2 3.3	5 27.8 17.9 3.3	18 11.8
Commercial Cafe	1 20.0 7.7 .7		2 40.0 4.3 1.3		2 40.0 7.1 1.3	5 3.3
Lodging					3 100.0 10.7 2.0	3 2.0
Business & Industry	1 5.9 7.7 .7	6 35.3 19.4 3.9	6 35.3 12.8 3.9	3 17.6 9.1 2.0	1 5.9 3.6 .7	17 11.2
Hospital/ Nursing	3 6.5 23.1 2.0	7 15.2 22.6 4.6	16 34.8 34.0 10.5	13 28.3 39.4 8.6	7 15.2 25.0 4.6	46 30.3
College/ University	2 5.6 15.4 1.3	9 25.0 29.0 5.9	11 30.6 23.4 7.2	8 22.2 24.2 5.3	6 16.7 21.4 3.9	36 23.7
Deli					1 100.0 3.6 .7	1 .7
Primary/ Secondary			1 100.0 2.1 .7			1 .7
Catering				1 100.0 3.0 .7		1 .7
Military	3 25.0 23.1 2.0	3 16.7 6.5 1.3	2 16.7 4.3 1.3	2 16.7 6.1 1.3	3 25.0 10.7 2.0	12 7.9
Column Total	13 8.6	31 20.4	47 30.9	33 21.7	28 18.4	152 100.0

Crosstabulation

Table 2.13

Annual Sales by Use of Recycled Material

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	3 15.0 27.3 2.0	6 30.0 19.4 4.0	5 25.0 10.6 3.4	4 20.0 12.5 2.7	2 10.0 7.1 1.3	20 13.4
\$300,000 - 399,999		5 41.7 16.1 3.4	5 41.7 10.6 3.4	1 8.3 3.1 .7	1 8.3 3.6 .7	12 8.1
\$400,000 - 499,999	1 4.8 9.1 .7	2 9.5 6.5 1.3	7 33.3 14.9 4.7	6 28.6 18.8 4.0	5 23.8 17.9 3.4	21 14.1
\$500,000 - 599,999	1 25.0 9.1 .7	1 25.0 3.2 .7		1 25.0 3.1 .7	1 25.0 3.6 .7	4 2.7
\$600,000 - 799,999	1 5.6 9.1 .7	6 33.3 19.4 4.0	4 22.2 8.5 2.7	4 22.2 12.5 2.7	3 16.7 10.7 2.0	18 12.1
\$800,000 - 999,999	2 25.0 18.2 1.3		3 37.5 6.4 2.0	3 37.5 9.4 2.0		8 5.4
\$1 Million - 1,999,999	3 10.3 27.3 2.0	7 24.1 22.6 4.7	3 10.3 6.4 2.0	7 24.1 21.9 4.7	9 31.0 32.1 6.0	29 19.5
\$2 Million - 2,999,999			7 70.0 14.9 4.7	1 10.0 3.1 .7	2 20.0 7.1 1.3	10 6.7
\$3 Million - 3,999,999		1 12.5 3.2 .7	6 75.0 12.8 4.0		1 12.5 3.6 .7	8 5.4
\$5 Million - 5,999,999			2 28.6 4.3 1.3	4 57.4 12.5 2.7	1 14.3 3.6 .7	7 4.7
Over \$6 Million		3 25.0 9.7 2.0	5 41.7 10.6 3.4	1 8.3 3.1 .7	3 25.0 10.7 2.0	12 8.1
Column Total	11 7.4	31 20.8	47 31.5	32 21.5	28 18.8	149 100.0

equally split, two (50%) assigning "extremely" or "very" important ranking and two (50%) assigning a "somewhat" or "not important" ranking.

Crosstabulation Analysis of Importance of the Package's Ability to Control the Waste of Product

This criteria was ranked as being "very" or "extremely" important by a majority of respondents from each segment. The Full Service segment was the most normally distributed with thirty three percent of the respondents falling on either side of the "important" ranking. The Commercial Cafeteria segment was the most significantly skewed in favor of the "extremely" important ranking (80% of respondents assigned the extremely important ranking). Ninety one percent (91.7%) of the Military operations assigned an "extremely" or "very" important ranking to this criteria.

Analysis of Sales Volume data reflects a consistent evaluation and importance ranking of this criteria. Operators assign a high degree of importance to this criteria regardless of sales volume. The most normally distributed data is reflected in the \$400,000-\$499,999 range with thirty eight percent (38.1%) of the respondents assigning a "somewhat" or "not important" ranking to this criteria. However, a majority of operators (47.6%) with sales volume in this range assigned "very" or "extremely" important ranking to this criteria. In some ranges (\$500,000-

Crosstabulation

Table 2.14 Type of Operation by Control Waste of Product

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	7 58.3 13.7 4.6	3 25.0 6.0 2.0	1 8.3 2.9 .7	1 8.3 7.7 .7		12 7.8
Full Service	3 16.7 5.9 2.0	3 16.7 6.0 2.0	6 33.3 17.6 3.9	4 22.2 30.8 2.6	2 11.1 40.0 1.3	18 11.8
Commercial Cafe	4 80.0 7.8 2.6		1 20.0 2.9 .7			5 3.3
Lodging	2 66.7 3.9 1.3		1 33.3 2.9 .7			3 2.0
Business & Industry	4 22.2 7.8 2.6	8 44.4 16.0 5.2	4 22.2 11.8 2.6	2 11.1 15.4 1.3		18 11.8
Hospital/ Nursing	16 34.8 31.4 10.5	13 28.3 26.0 8.5	12 26.1 35.3 7.8	3 6.5 23.1 2.0	2 4.3 40.0 1.3	46 30.1
College/ University	8 22.2 15.7 5.2	17 47.2 34.0 11.1	8 22.2 23.5 5.2	3 8.3 23.1 2.0		36 23.5
Deli					1 100.0 20.0 .7	1 .7
Primary/ Secondary		1 100.0 2.0 .7				1 .7
Catering	1 100.0 2.0 .7					1 .7
Military	6 50.0 11.8 3.9	5 41.7 10.0 3.3	1 8.3 2.9 .7			12 7.8
Column Total	51 33.3	50 32.7	34 22.2	13 8.5	5 3.3	153 100.0

Crosstabulation

Table 2.15

Annual Sales Volume by Control Waste of Product

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	7 35.0 14.6 4.7	3 15.0 6.0 2.0	8 40.0 23.5 5.3	1 5.0 7.7 .7	1 5.0 20.0 .7	20 13.3
\$300,000 - 399,999	3 25.0 6.3 2.0	6 50.0 12.0 4.0	3 25.0 8.8 2.0			12 8.0
\$400,000 - 499,999	5 23.8 10.4 3.3	5 23.8 10.0 3.3	3 14.3 8.8 2.0	5 23.8 38.5 3.3	3 14.3 60.0 2.0	21 14.0
\$500,000 - 599,999	2 50.0 4.2 1.3	1 25.0 2.0 .7	1 25.0 2.9 .7			4 2.7
\$600,000 - 799,999	9 50.0 18.8 6.0	7 38.9 14.0 4.7	1 5.6 2.9 .7	1 5.6 7.7 .7		18 12.0
\$800,000 - 999,999	3 37.5 6.3 2.0	4 50.0 8.0 2.7	1 12.5 2.9 .7			8 5.3
\$1 Million - 1,999,999	10 33.3 20.8 6.7	11 36.7 22.0 7.3	8 26.7 23.5 5.3		1 3.3 20.0 .7	30 20.0
\$2 Million - 2,999,999	3 30.0 6.3 2.0	3 30.0 6.0 2.0	1 10.0 2.9 .7	3 30.0 23.1 2.0		10 6.7
\$3 Million - 3,999,999	1 12.5 2.1 .7	3 37.5 6.0 2.0	3 37.5 8.8 2.0	1 12.5 7.7 .7		8 5.3
\$5 Million - 5,999,999	3 42.9 6.3 2.0	1 14.3 2.0 .7	2 28.6 5.9 1.3	1 14.3 7.7 .7		7 4.7
Over \$6 Million	2 16.7 4.2 1.3	6 50.0 12.0 4.0	3 25.0 8.8 2.0	1 8.3 7.7 .7		12 8.0
Column Total	48 32.0	50 33.3	34 22.7	13 8.7	5 3.3	150 100.0

\$599,999 and \$600,000-\$799,999) as many as fifty percent of the respondents assigned a rank of "extremely" important to this criteria.

Crosstabulation Analysis of Importance of Package Storage Efficiency

Operators across all segments assigned either an "extremely" important or "very" important ranking to this criteria. The most neutral segment was the Commercial Cafeteria segment; eight percent (4) respondents assigned an "important" ranking to this criteria. Fast Food, Lodging and Military segments were the most skewed to the "extremely" important rank; with fifty percent, sixty six percent (66.7%) and fifty percent respectively assigning the "extremely" important ranking.

Analysis of this criteria by operator sales volume yields little additional insight. In general, operators of all sizes assigned a high degree of importance to this criteria.

Crosstabulation Analysis of Convenience in Opening Package

There is marked segment difference in the importance ranking of package opening convenience. Operators from the Business and Industry, Hospital and Nursing, and the Military segments assigned above average importance ranking to the opening convenience criteria. Forty four percent (44.5%) of respondents

Table 2.16

Type of Operation by Efficiency in Storage

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	6 50.0 14.0 3.9	2 16.7 3.8 1.3	3 25.0 6.3 2.0	1 8.3 11.1 .7		12 7.8
Full Service	5 27.8 11.6 3.3	7 38.9 13.5 4.6	5 27.8 10.4 3.3	1 5.6 11.1 .7		18 11.8
Commercial Cafe			4 80.0 8.3 2.6	1 20.0 11.1 .7		5 3.3
Lodging	2 66.7 4.7 1.3		1 33.3 2.1 .7			3 2.0
Business & Industry	6 33.3 14.0 3.9	5 27.8 9.6 3.3	7 38.9 14.6 4.6			18 11.8
Hospital/ Nursing	11 23.9 25.6 7.2	16 34.8 30.8 10.5	17 37.0 35.4 11.1	2 4.3 22.2 1.3		46 30.1
College/ University	6 16.7 14.0 3.9	17 47.2 32.7 11.1	9 25.0 18.8 5.9	4 11.1 44.4 2.6		36 23.5
Deli					1 100.0 100.0 .7	1 .7
Primary/ Secondary		1 100.0 1.9 .7				1 .7
Catering	1 100.0 2.3 .7					1 .7
Military	6 50.0 14.0 3.9	4 33.3 7.7 2.6	2 16.7 4.2 1.3			12 7.8
Column Total	43 28.1	52 34.0	48 31.4	9 5.9	1 .7	153 100.0

Crosstabulation

Table 2.17

Annual Sales Volume by Efficiency in Storage

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	6 30.0 14.6 4.0	6 30.0 11.3 4.0	7 35.0 15.2 4.7		1 5.0 100.0 .7	20 13.3
\$300,000 - 399,999	2 16.7 4.9 1.3	7 58.3 13.2 4.7	3 25.0 6.5 2.0			12 8.0
\$400,000 - 499,999	5 23.8 12.2 3.3	4 19.0 7.5 2.7	6 28.6 13.0 4.0	6 28.6 66.7 4.0		21 14.0
\$500,000 - 599,999	2 50.0 4.9 1.3	1 25.0 1.9 .7	1 25.0 2.2 .7			4 2.7
\$600,000 - 799,999	5 27.8 12.2 3.3	8 44.4 15.1 5.3	4 22.2 8.7 2.7	1 5.6 11.1 .7		18 12.0
\$800,000 - 999,999	4 50.0 9.8 2.7	3 37.5 5.7 2.0	1 12.5 2.2 .7			8 5.3
\$1 Million - 1,999,999	10 33.3 24.4 6.7	8 26.7 15.1 5.3	11 36.7 23.9 7.3	1 3.3 11.1 .7		30 20.0
\$2 Million - 2,999,999	4 40.0 9.8 2.7	4 40.0 7.5 2.7	2 20.0 4.3 1.3			10 6.7
\$3 Million - 3,999,999		5 62.5 9.4 3.3	3 37.5 6.5 2.0			8 5.3
\$5 Million - 5,999,999	2 28.6 4.9 1.3	2 28.6 3.8 1.3	3 42.9 6.5 2.0			7 4.7
Over \$6 Million	1 8.3 2.4 .7	5 41.7 9.4 3.3	5 41.7 10.9 3.3	1 8.3 11.1 .7		12 8.0
Column Total	41 27.3	53 35.3	46 30.7	9 6.0	1 .7	150 100.0

Crosstabulation

Table 2.18

Type of Operation by Convenience in Opening

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	2 18.2 11.1 1.3	1 9.1 2.9 .7	4 36.4 7.0 2.6	2 18.2 5.6 1.3	2 18.2 28.6 1.3	11 7.2
Full Service	2 11.1 11.1 1.3	4 22.2 11.8 2.6	5 27.8 8.8 3.3	6 33.3 16.7 3.9	1 5.6 14.3 .7	18 11.8
Commercial Cafe			2 40.0 3.5 1.3	2 40.0 5.6 1.3	1 20.0 14.3 .7	5 3.3
Lodging	1 33.3 5.6 .7		1 33.3 1.8 .7	1 33.3 2.8 .7		3 2.0
Business & Industry	3 16.7 16.7 2.0	5 27.8 14.7 3.3	7 38.9 12.3 4.6	3 16.7 8.3 2.0		18 11.8
Hospital/ Nursing	6 13.0 33.3 3.9	12 26.1 35.3 7.9	18 39.1 31.6 11.8	9 19.6 25.0 5.9	1 2.2 14.3 .7	46 30.3
College/ University	2 5.6 11.1 1.3	8 22.2 23.5 5.3	15 41.7 26.3 9.9	10 27.8 27.8 9.9	1 2.8 14.3 .7	36 23.7
Deli					1 100.0 14.3 .7	1 .7
Primary/ Secondary		1 100.0 2.9 .7				1 .7
Catering			1 100.0 1.8 .7			1 .7
Military	2 16.7 11.1 1.3	3 25.0 8.8 2.0	4 33.3 7.0 2.6	3 25.0 8.3 2.0		12 7.9
Column Total	18 11.8	34 22.4	57 37.5	36 23.7	7 4.6	152 100.0

Crosstabulation

Table 2.19

Annual Sales Volume by Convenience in Opening

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	3 15.8 18.8 2.0	7 36.8 20.6 4.7	4 21.1 7.0 2.7	4 21.1 11.4 2.7	1 5.3 14.3 .7	19 12.8
\$300,000 - 399,999		4 33.3 11.8 2.7	5 41.7 8.8 3.4	3 25.0 8.6 2.0		12 8.1
\$400,000 - 499,999	2 9.5 12.5 1.3	4 19.0 11.8 2.7	6 28.6 10.5 4.0	6 28.6 17.1 4.0	3 14.3 42.9 2.0	21 14.1
\$500,000 - 599,999		1 25.0 2.9 .7	1 25.0 1.8 .7	2 50.0 5.7 1.3		4 2.7
\$600,000 - 799,999	2 11.1 12.5 1.3	6 33.3 17.6 4.0	6 33.3 10.5 4.0	3 16.7 8.6 2.0	1 5.6 14.3 .7	18 12.1
\$800,000 - 999,999	1 12.5 6.3 .7	1 12.5 2.9 .7	3 37.5 5.3 2.0	3 37.5 8.6 2.0		8 5.4
\$1 Million - 1,999,999	5 16.7 31.3 3.4	4 13.3 11.8 2.7	14 46.7 24.6 9.4	6 20.0 17.1 4.0	1 3.3 14.3 .7	30 20.1
\$2 Million - 2,999,999	2 20.0 12.5 1.3	2 20.0 5.9 1.3	4 40.0 7.0 2.7	1 10.0 2.9 .7	1 10.0 14.3 .7	10 6.7
\$3 Million - 3,999,999		2 25.0 5.9 1.3	4 50.0 7.0 2.7	2 25.0 5.7 1.3		8 5.4
\$5 Million - 5,999,999	1 14.3 6.3 .7	2 28.6 5.9 1.3	1 14.3 1.8 .7	3 42.9 8.6 2.0		7 4.7
Over \$6 Million		1 8.3 2.9 .7	9 75.0 15.8 6.0	2 16.7 5.7 1.3		12 8.1
Column Total	16 10.7	34 22.8	57 28.3	35 23.5	7 4.7	149 100.0

in the Business and Industry segment assigned an "extremely" or "very" important ranking to this criteria. Forty one percent (41.7%) of the Military operations assigned an importance of "very" or "extremely" important. Thirty nine percent (39.1%) of the Hospital and Nursing segment respondents assigned the "extremely" or "very" important ranking. The data for the other segments are generally more normally distributed. The data from the three previously mentioned segments are decidedly skewed to the "extremely" important ranking.

Analysis of the crosstab result for this criteria by operator sales volume indicates there is a difference in perceived importance of this criteria. Respondents in the \$100,00-\$299,999, the \$2 million-\$2,999,999 and \$5 million-\$5,999,999 sales volume ranges assigned a higher importance rank (as a percent of segment population) to this criteria. The operators from these volume ranges assigned "extremely" or "very" important rankings by the respective percentages of fifty two percent (52.6%), forty percent, and forty two percent (42.9%).

Crosstabulation Analysis of Importance of Package in Providing Convenience in Dispensing

Operators across all segments do not appear to exhibit strong importance ranking of this criteria. The data reflect relatively normal distribution of the importance ranking. Those

Crosstabulation

Table 2.20

Type of Operation by Convenience in Dispensing

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	3 27.3 13.6 2.0	1 9.1 2.8 .7	4 36.4 6.3 2.6		3 27.3 50.0 2.0	11 7.2
Full Service	3 16.7 13.6 2.0	4 22.2 11.1 2.6	5 27.8 7.9 3.3	5 27.8 20.0 3.3	1 5.6 16.7 .7	18 11.8
Commercial Cafe			3 60.0 4.8 2.0	2 40.0 8.0 1.3		5 3.3
Lodging	1 33.3 4.5 .7		1 33.3 1.6 .7	1 33.3 4.0 .7		3 2.0
Business & Industry	4 22.2 18.2 2.6	4 22.2 11.1 2.6	8 44.4 12.7 5.3	2 11.1 8.0 1.3		18 11.8
Hospital/ Nursing	6 13.0 27.3 3.9	15 32.6 41.7 9.9	18 39.1 28.6 11.8	7 15.2 28.0 4.6		46 30.3
College/ University	3 8.3 13.6 2.0	9 25.0 25.0 5.9	18 50.0 28.6 11.8	5 13.9 20.0 3.3	1 2.8 16.7 .7	36 23.7
Deli					1 100.0 16.7 .7	1 .7
Primary/ Secondary			1 100.0 1.6 .7			1 .7
Catering			1 100.0 1.6 .7			1 .7
Military	2 16.7 9.1 1.3	3 25.0 8.3 2.0	4 33.3 6.3 2.6	3 25.0 12.0 2.0		12 7.9
Column Total	22 14.5	36 23.7	63 41.4	25 16.4	6 3.9	152 100.0

Crosstabulation

Table 2.21

Annual Sales Volume by Convenience in Dispensing

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	3 15.8 15.0 2.0	7 36.8 19.4 4.7	5 26.3 8.1 3.4	3 15.8 12.0 2.0	1 5.3 16.7 .7	19 12.8
\$300,000 - 399,999		5 41.7 13.9 3.4	3 25.0 4.8 2.0	3 25.0 12.0 2.0	1 8.3 16.7 .7	12 8.1
\$400,000 - 499,999	3 14.3 15.0 2.0	5 23.8 13.9 3.4	7 33.3 11.3 4.7	4 19.0 16.0 2.7	2 9.5 33.3 1.3	21 14.1
\$500,000 - 599,999		1 25.0 2.8 .7	2 50.0 3.2 1.3	1 25.0 4.0 .7		4 2.7
\$600,000 - 799,999	4 22.2 20.0 2.7	4 22.2 11.1 2.7	7 38.9 11.1 4.7	2 11.1 8.0 1.3	1 5.6 16.7 .7	18 12.1
\$800,000 - 999,999	1 12.5 5.0 .7	2 25.0 5.6 1.3	3 37.5 4.8 2.0	2 25.0 8.0 1.3		8 5.4
\$1 Million - 1,999,999	5 16.7 25.0 3.4	7 23.3 19.4 4.7	13 43.3 21.0 8.7	4 13.3 16.0 2.7	1 3.3 16.7 .7	30 20.1
\$2 Million - 2,999,999	3 30.0 15.0 2.0	1 10.0 2.8 .7	2 20.0 3.2 1.3	4 40.0 16.0 2.7		10 6.7
\$3 Million - 3,999,999		2 25.0 5.6 1.3	5 62.5 8.1 3.4	1 12.5 4.0 .7		8 5.4
\$5 Million - 5,999,999	1 14.3 5.0 .7	1 14.3 2.8 .7	5 71.4 8.1 3.4			7 4.7
Over \$6 Million		1 8.3 2.8 .7	10 83.3 16.1 6.7	1 8.3 4.0 .7		12 8.1
Column Total	20 13.4	36 24.2	62 41.6	25 16	6 4.0	149 100.0

segments skewed to the "extremely" and "very" important ranking are the non-commercial segments of Business and Industry, Hospital and Nursing and Military. The bulk of the data across all segments was between the "very" important, the "important" and the "somewhat" important rankings.

Respondents with sales volumes in the \$100,000-\$299,999, the \$300,000-\$399,999 and, the \$600,000-\$799,999 assigned an overall higher importance rank to this criteria. The respective percentages in the "extremely" or "very" important ranking were fifty two percent (52.6%), forty one percent (41.7%, all in the "very" important rank) and forty four percent (44.4%). Operations in the \$1 million to \$3 million range also assigned a high degree of importance to this criteria. Forty percent of respondents with sales in the \$1 million-\$1,999,999 range, assigned either "very" or "extremely" important ranking to this criteria.

Crosstabulation Analysis of Importance of Ability to Reseal the Package

The Full Service, Hospital and Nursing, and Military segments placed the highest relative degree of importance on the ability to reseal the package. Forty four percent of the respondents from the Full Service and Hospital and Nursing segments assigned an importance ranking of "very" or "extremely"

Crosstabulation

Table 2.22

Type of Operation by Ability to Reseal

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	3 27.3 10.7 2.0	1 9.1 2.8 .7	2 18.2 4.5 1.3	3 27.3 10.0 2.0	2 18.2 15.4 1.3	11 7.3
Full Service	4 22.2 14.3 2.6	4 22.2 11.1 2.6	6 33.3 13.6 4.0	1 5.6 3.3 .7	3 16.7 23.1 2.0	18 11.9
Commercial Cafe	1 20.0 3.6 .7		1 20.0 2.3 .7	2 40.0 6.7 1.3	1 20.0 7.7 .7	5 3.3
Lodging		1 33.3 2.8 .7	2 66.7 4.5 1.3			3 2.0
Business & Industry	4 22.2 14.3 2.6	3 16.7 8.3 2.0	5 27.8 11.4 3.3	4 22.2 13.3 2.6	2 11.1 15.4 1.3	18 11.9
Hospital/ Nursing	9 20.0 32.1 6.0	11 24.4 30.6 7.3	17 37.8 38.6 11.3	7 15.6 23.3 4.6	1 2.2 7.7 .7	45 29.8
College/ University	3 8.3 10.7 2.0	11 30.6 30.6 7.3	9 25.0 20.5 6.0	11 30.6 36.7 7.3	2 5.6 15.4 1.3	36 23.8
Deli					1 100.0 7.7 .7	1 .7
Primary/ Secondary		1 100.0 2.8 .7				1 .7
Catering				1 100.0 3.3 .7		1 .7
Military	4 33.3 14.3 2.6	4 33.3 11.1 2.6	2 16.7 4.5 1.3	1 8.3 3.3 .7	1 8.3 7.7 .7	12 7.9
Column Total	28 18.5	36 23.8	44 29.1	30 19.9	13 8.6	151 100.0

Cross Tabulation

Table 2.23

Annual Sales Volume by Ability to Reseal

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	5 26.3 18.5 3.4	4 21.1 11.4 2.7	7 36.8 16.3 4.7		3 15.8 21.4 2.0	19 12.8
\$300,000 - 399,999		4 33.3 11.4 2.7	3 25.0 7.0 2.0	3 25.0 10.3 2.0	2 16.7 14.3 1.4	12 8.1
\$400,000 - 499,999	3 15.0 11.1 2.0	3 15.0 8.6 2.0	6 30.0 14.0 4.1	5 25.0 17.2 3.4	3 15.0 21.4 2.0	20 13.5
\$500,000 - 599,999	1 25.0 3.7 .7	1 25.0 2.9 .7	1 25.0 2.3 .7		1 25.0 7.1 .7	4 2.7
\$600,000 - 799,999	5 27.8 18.5 3.4	4 22.2 11.4 2.7	5 27.8 11.6 3.4	3 16.7 10.3 2.0	1 5.6 7.1 .7	18 12.2
\$800,000 - 999,999	1 12.5 3.7 .7	2 25.0 5.7 1.4	3 37.5 7.0 2.0	2 25.0 6.9 1.4		8 5.4
\$1 Million - 1,999,999	8 26.7 29.6 5.4	10 33.3 28.6 6.8	5 16.7 11.6 3.4	6 20.0 20.7 4.1	1 3.3 7.1 .7	30 20.3
\$2 Million - 2,999,999	3 30.0 11.1 2.0	2 20.0 5.7 1.4	2 20.0 4.7 1.4	2 20.0 6.9 1.4	1 10.0 7.1 .7	10 6.8
\$3 Million - 3,999,999	12.5 3.7 .7	1 12.5 2.9 .7	5 62.5 11.6 3.4		1 12.5 7.1 .7	8 5.4
\$5 Million - 5,999,999		2 28.6 5.7 1.4	3 42.9 7.0 2.0	2 28.6 6.9 1.4		7 4.7
Over \$6 Million		2 16.7 5.7 1.4	3 25.0 7.0 2.0	6 50.0 20.7 4.1	1 8.3 7.1 .7	12 8.1
Column Total	27 18.2	35 23.6	43 29.1	29 19.6	14 9.5	148 100.0

important to this criteria. Sixty six percent (66.6%) of the respondents from the Military segment assigned an importance ranking of "very" or "extremely" important to this criteria.

In general, larger volume foodservice operators evaluated this criteria as being less important. Operations with sales volume in excess of \$3 million assigned mostly "important" rankings to this criteria. Operations with revenue under \$3 million tended to rank this criteria with a higher relative importance. Fifty percent of respondents with sales ranging from \$2 million-\$2,999,999, \$600,000-\$799,999 and \$500,000-\$599,999, assigned "very" or "extremely" important rankings to this criteria. The sales volume category assigning the highest relative degree of importance to this criteria was the \$1 million-\$1,999,999 range. Sixty percent of respondents in this revenue range assigned an importance ranking of "very" or "extremely" important to the ability to reseal criteria.

Crosstabulation Analysis of Importance of Package's Role in Extending the Shelf Life of the Product

Analysis of this criteria indicates that segment responses are generally consistent with the mean values for the sample population as a whole. Of all the statistically significant segments, only one segment appears to be inconsistent with the

Table 2.24

Type of Operation by Extended Shelf Life

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	5 45.5 9.4 3.3	1 9.1 2.0 .7	4 36.4 11.4 2.6		1 9.1 14.3 .7	11 7.2
Full Service	8 44.4 15.1 5.3	6 33.3 12.2 3.9	3 16.7 8.6 2.0	1 5.6 12.5 .7		18 11.8
Commercial Cafe		1 20.0 2.0 .7	1 20.0 2.9 .7	2 40.0 25.0 1.3	1 20.0 14.3 .7	5 3.3
Lodging	1 33.3 1.9 .7	1 33.3 2.0 .7	1 33.3 2.9 .7			3 2.0
Business & Industry	4 22.2 7.5 2.6	5 27.8 10.2 3.3	8 44.4 22.9 5.3	1 5.6 12.5 .7		18 11.8
Hospital/ Nursing	19 41.3 35.8 12.5	14 30.4 28.6 9.2	9 19.6 25.7 5.9	3 6.5 37.5 2.0	1 2.2 14.3 .7	46 30.3
College/ University	11 30.6 20.8 7.2	15 41.7 30.6 9.9	7 19.4 20.0 4.6	1 2.8 12.5 .7	2 5.6 28.6 1.3	36 23.7
Deli					1 100.0 14.3 .7	1 .7
Primary/ Secondary					1 100.0 14.3 .7	1 .7
Catering		1 100.0 2.0 .7				1 .7
Military	5 41.7 9.4 3.3	5 41.7 10.2 3.3	2 16.7 5.7 1.3			12 7.9
Column Total	53 34.9	49 32.2	35 23.0	8 5.3	7 4.6	152 100.0

Crosstabulation

Table 2.25

Annual Sales Volume by Extended Shelf Life

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	7 36.8 14.0 4.7	6 31.6 12.0 4.0	5 26.3 14.7 3.4		1 5.3 14.3 .7	19 12.8
\$300,000 - 399,999	6 50.0 12.0 4.0	3 25.0 6.0 2.0	1 8.3 2.9 .7	1 8.3 12.5 .7	1 8.3 14.3 .7	12 8.1
\$400,000 - 499,999	7 33.3 14.0 4.7	4 19.0 8.0 2.7	9 42.9 26.5 6.0	1 4.8 12.5 .7		21 14.1
\$500,000 - 599,999	3 75.0 6.0 2.0			1 25.0 12.5 .7		4 2.7
\$600,000 - 799,999	6 33.3 12.0 4.0	9 50.0 18.0 6.0	2 11.1 5.9 1.3	1 5.6 12.5 .7		18 12.1
\$800,000 - 999,999	2 25.0 4.0 1.3	5 62.5 10.0 3.4	1 12.5 2.9 .7			8 5.4
\$1 Million - 1,999,999	12 40.0 24.0 8.1	9 30.0 18.0 6.0	8 26.7 23.5 5.4	1 3.3 12.5 .7		30 20.1
\$2 Million - 2,999,999	4 40.0 8.0 2.7	2 20.0 4.0 1.3	1 10.0 2.9 .7	1 10.0 12.5 .7	2 20.0 28.6 1.3	10 6.7
\$3 Million - 3,999,999	2 25.0 4.0 1.3	5 62.5 10.0 3.4	1 12.5 2.9 .7			8 5.4
\$5 Million - 5,999,999		4 57.4 8.0 2.7	3 42.9 8.8 2.0			7 4.7
Over \$6 Million	1 8.3 2.0 .7	3 25.0 6.0 2.0	3 25.0 8.8 2.0	2 16.7 25.0 1.3	3 25.0 42.9 2.0	12 8.1
Column Total	50 33.6	50 33.6	34 22.8	8 5.4	7 4.7	149 100.0

population mean responses. Most segments placed a high degree of importance on this criteria. Eighty three percent (83.4%) of the respondents from the Military segment assigned an importance rank of "very" or "extremely" important. The other segments, with one exception, also assigned high importance ranking to this criteria; with as many as fifty percent, or more, of the respondents assigning an importance ranking of "very" or "important." The only segment not assigning a high degree of importance to the shelf life extension criteria was the Commercial Cafeteria assigned an importance ranking of "somewhat" or "not important."

The crosstabulation of importance ranking for this criteria across the sales volume categories is generally consistent with the segment specific data. The package's ability to extend product shelf life is considered to be an "important" criteria in the Foodservice operator's purchasing process.

Crosstabulation Analysis of Importance of Package in Controlling Portion Size

The data are generally normally distributed for most of the segments ranking the importance of this criteria. The data are skewed in favor of "very" and "extremely" important rankings. Three segments; the Military segment, the Business and Industry segment and the Hospital and Nursing segment, are decidedly

Crosstabulation

Table 2.26

Type of Operation by Portion Size

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	3 27.3 8.6 2.0	1 9.1 2.5 .7	6 54.5 11.8 4.0	1 9.1 6.3 .7		11 7.3
Full Service	4 22.2 11.4 2.6	4 22.2 10.0 2.6	8 44.4 15.7 5.3	1 5.6 6.3 .7	1 5.6 11.1 .7	18 11.9
Commercial Cafe		2 40.0 5.0 1.3	1 20.0 2.0 .7	2 40.0 12.5 1.3		5 3.3
Lodging	1 33.3 2.9 .7		2 66.7 3.9 1.3			3 2.0
Business & Industry	2 11.8 5.7 1.3	8 47.1 20.0 5.3	5 29.4 9.8 3.3	1 5.9 6.3 .7	1 5.9 11.1 .7	17 11.3
Hospital/ Nursing	9 19.6 25.7 6.0	15 32.6 37.5 9.9	18 39.1 35.3 11.9	3 6.5 18.8 2.0	1 2.2 11.1 .7	46 30.5
College/ University	10 27.8 28.6 6.6	6 16.7 15.0 4.0	9 25.0 17.6 6.0	6 16.7 37.5 4.0	5 13.9 55.6 3.3	36 23.8
Deli					1 100.0 11.1 .7	1 .7
Primary/ Secondary			1 100.0 2.0 .7			1 .7
Catering				1 100.0 6.3 .7		1 .7
Military	6 50.0 17.1 4.0	4 33.3 10.0 2.6	1 8.3 2.0 .7	1 8.3 6.3 .7		12 7.9
Column Total	35 23.2	40 26.5	51 33.8	16 10.6	9 6.0	151 100.0

Annual Sales Volume by Portion Size

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	6 31.6 17.6 4.1	5 26.3 12.5 3.4	6 31.6 11.8 4.1	1 5.3 6.7 .7	1 5.3 12.5 .7	19 12.8
\$300,000 - 399,999	3 25.0 8.8 2.0	4 33.3 10.0 2.7	4 33.3 7.8 2.7	1 8.3 6.7 .7		12 8.1
\$400,000 - 499,999	2 9.5 5.9 1.4	4 19.0 10.0 2.7	10 47.6 19.6 6.8	3 14.3 20.0 2.0	2 9.5 25.0 1.4	21 14.2
\$500,000 - 599,999	2 50.0 5.9 1.4		1 25.0 2.0 .7	1 25.0 6.7 .7		4 2.7
\$600,000 - 799,999	4 22.2 11.8 2.7	8 44.4 20.0 5.4	3 16.7 5.9 2.0	3 16.7 20.0 2.0		18 12.2
\$800,000 - 999,999	3 37.5 8.8 2.0	2 25.0 5.0 1.4	1 12.5 2.0 .7	2 25.0 13.3 1.4		8 5.4
\$1 Million - 1,999,999	8 26.7 23.5 5.4	8 26.7 20.0 5.4	10 33.3 19.6 6.8	1 3.3 6.7 .7	3 10.0 37.5 2.0	30 20.3
\$2 Million - 2,999,999	2 20.0 5.9 1.4	3 30.0 7.5 2.0	3 30.0 5.9 2.0	1 10.0 6.7 .7	1 10.0 12.5 .7	10 6.8
\$3 Million - 3,999,999	1 12.5 2.9 .7	3 37.5 7.5 2.0	3 37.5 5.9 2.0	1 12.5 6.7 .7		8 5.4
\$5 Million - 5,999,999	1 14.3 2.9 .7		6 85.7 11.8 4.1			7 4.7
Over \$6 Million	2 18.2 5.9 1.4	3 27.3 7.5 2.0	4 36.4 7.8 2.7	1 9.1 6.7 .7	1 9.1 12.5 .7	11 7.4
Column Total	34 23.0	40 27.0	51 34.5	15 10.1	8 5.4	148 100.0

skewed to the "extremely" important ranking. Eighty three percent (83.3%) of the Military segment respondents assigned a "very" or "extremely" important ranking to this criteria. Fifty eight percent (58.9%) of the Business and Industry respondents, and fifty two percent (52.2%) of the Hospital and Nursing segments respondents assigned an importance ranking of "very" or "extremely" important to this criteria.

The data for this criteria, relative to sales volume, are generally consistent with the sample mean data and segment specific data. The data are skewed in favor of "extremely" or "very" important rankings but are generally normally distributed across all rankings.

Crosstabulation Analysis of Ability of Package to Preserve Nutritional Value of the Product

Respondents across all segments assigned a relatively high degree of importance to this criteria. This is consistent with the sample mean ranking of this criteria. No one segment was significantly inconsistent with the sample mean rank. A high percentage of the respondents in each segment (as high as 81.8% of the Fast Food respondents) assigned "very" or "extremely" important rankings to this criteria.

Crosstabulation

Table 2.28

Type of Operation by Preserve Nutritional Value

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	6 54.5 13.0 3.9	3 27.3 5.8 2.0	1 9.1 2.2 .7	1 9.1 14.3 .7		11 7.2
Full Service	4 22.2 8.7 2.6	5 27.8 9.6 3.3	7 38.9 15.6 4.6	2 11.1 28.6 1.3		18 11.8
Commercial Cafe		2 40.0 3.8 1.3	2 40.0 4.4 1.3	1 20.0 14.3 .7		5 3.3
Lodging		1 33.3 1.9 .7	1 33.3 2.2 .7	1 33.3 14.3 .7		3 2.0
Business & Industry	4 22.2 8.7 2.6	6 33.3 11.5 3.9	7 38.9 15.6 4.6	1 5.6 14.3 .7		18 11.8
Hospital/ Nursing	18 39.1 39.1 11.8	13 28.3 25.0 8.6	15 32.6 33.3 9.9			46 30.3
College/ University	10 27.8 21.7 6.6	16 44.4 30.8 10.5	8 22.2 17.8 5.3	1 2.8 14.3 .7	1 2.8 50.0 .7	36 23.7
Deli					1 100.0 50.0 .7	1 .7
Primary/ Secondary		1 100.0 1.9 .7				1 .7
Catering			1 100.0 2.2 .7			1 .7
Military	4 33.3 8.7 2.6	5 41.7 9.6 3.3	3 25.0 6.7 2.0			12 7.9
Column Total	46 30.3	52 34.2	45 29.6	7 4.6	2 1.3	152 100.0

Crosstabulation

Table 2.29

Annual Sales Volume by Preserve Nutritional Value

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	4 21.1 9.3 2.7	6 31.6 11.8 4.0	8 42.1 17.4 5.4		1 5.3 50.0 .7	19 12.8
\$300,000 - 399,999	4 33.3 9.3 2.7	6 50.0 11.8 4.0	2 16.7 4.3 1.3			12 8.1
\$400,000 - 499,999	7 33.3 16.3 4.7	4 19.0 7.8 2.7	8 38.1 17.4 5.4	2 9.5 28.6 1.3		21 14.1
\$500,000 - 599,999	2 50.0 4.7 1.3		2 50.0 4.3 1.3			4 2.7
\$600,000 - 799,999	6 33.3 14.0 4.0	6 33.3 11.8 4.0	6 33.3 13.0 4.0			18 12.1
\$800,000 - 999,999	3 37.5 7.0 2.0	3 37.5 5.9 2.0	2 25.0 4.3 1.3			8 5.4
\$1 Million - 1,999,999	8 26.7 18.6 5.4	15 50.0 29.4 10.1	6 20.0 13.0 4.0	1 3.3 14.3 .7		30 20.1
\$2 Million - 2,999,999	4 40.0 9.3 2.7	2 20.0 3.9 1.3	3 30.0 6.5 2.0	1 10.0 14.3 .7		10 6.7
\$3 Million - 3,999,999	3 37.5 7.0 2.0	4 50.0 7.8 2.7	1 12.5 2.2 .7			8 5.4
\$5 Million - 5,999,999		3 42.9 5.9 2.0	3 42.9 6.5 2.0	1 14.3 14.3 .7		7 4.7
Over \$6 Million	2 16.7 4.7 1.3	2 16.7 3.9 1.3	5 41.7 10.9 3.4	2 16.7 28.6 1.3	1 8.3 50.0 .7	12 8.1
Column Total	43 28.9	51 34.2	46 30.9	7 4.7	2 1.3	149 100.0

Analysis of responses by sales volume yields no additional significant insight into the importance ranking of the package preservation function. Foodservice operators consider the package preservation function as an important purchasing criteria. It is important to note that this is consistent with operators' ranking of product based criteria. Operators' assigned high degrees of importance to the "color" and "flavor" product criteria. These organoleptic quality indicators are a direct function of the package's ability to preserve the nutritional value of the product.

Crosstabulation Analysis of Importance of Package Conveyance of Storage and Preparation Information

The percentage of respondents across each segment is generally normally distributed for this criteria. The respondents are slightly skewed the "very" or "extremely" ranking within most segments. The most frequent is the "important" ranking, indicating a generally neutral attitude towards the importance of this criteria. One segment, the Military segment is decidedly skewed in favor of an "extremely" important ranking. Fifty four percent (54.5%) of the respondents from this segment assigned an importance rank of "extremely" important to this criteria.

Respondents in the \$1 million-\$1,999,999 volume range

Crosstabulation

Table 2.30

Type of Operation by Storage and Prep Information

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	2 18.2 8.0 1.3	1 9.1 2.8 .7	3 27.3 5.8 2.0	3 27.3 11.1 2.0	2 18.2 20.0 1.3	11 7.3
Full Service	4 22.2 16.0 2.7	1 5.6 2.8 .7	6 33.3 11.5 4.0	6 33.3 22.2 4.0	1 5.6 10.0 .7	18 12.0
Commercial Cafe		2 40.0 5.6 1.3	3 60.0 5.8 2.0			5 3.3
Lodging			2 66.7 3.8 1.3	1 33.3 3.7 .7		3 2.0
Business & Industry		8 47.1 22.2 5.3	4 23.5 7.7 2.7	5 29.4 18.5 3.3		17 11.3
Hospital/ Nursing	8 17.4 32.0 5.3	13 28.3 36.1 8.7	19 41.3 36.5 12.7	5 10.9 18.5 3.3	1 2.2 10.0 .7	46 30.7
College/ University	5 13.9 20.0 3.3	9 25.0 25.0 6.0	12 33.3 23.1 8.0	5 13.9 18.5 3.3	5 13.9 50.0 3.3	36 24.0
Deli					1 100.0 10.0 .7	1 .7
Primary/ Secondary			1 100.0 1.9 .7			1 .7
Catering			1 100.0 1.9 .7			1 .7
Military	6 54.5 24.0 4.0	2 18.2 5.6 1.3	1 9.1 1.9 .7	2 18.2 7.4 1.3		11 7.3
Column Total	25 16.7	36 24.0	52 34.7	27 18.0	10 6.7	150 100.0

Crosstabulation

Table 2.31

Annual Sales Volume by Storage and Prep Information

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	5 27.8 20.8 3.4	3 16.7 9.1 2.0	7 38.9 13.5 4.8	2 11.1 7.1 1.4	1 5.6 10.0 .7	18 12.2
\$300,000 - 399,999		4 33.3 12.1 2.7	6 50.0 11.5 4.1	1 8.3 3.6 .7	1 8.3 10.0 .7	12 8.2
\$400,000 - 499,999	3 15.0 12.5 2.0	1 5.0 3.0 .7	8 40.0 15.4 5.4	5 25.0 17.9 3.4	3 15.0 30.0 2.0	20 13.6
\$500,000 - 599,999	2 50.0 8.3 1.4		1 25.0 1.9 .7	1 25.0 3.6 .7		4 2.7
\$600,000 - 799,999	2 11.1 8.3 1.4	1 12.5 3.0 .7	2 25.0 3.8 1.4	3 37.5 10.7 2.0		8 5.4
\$800,000 - 999,999	2 25.0 8.3 1.4	1 12.5 3.0 .7	2 25.0 3.8 1.4	3 37.5 10.7 2.0		8 5.4
\$1 Million - 1,999,999	8 26.7 33.3 5.4	11 36.7 33.3 7.5	4 13.3 7.7 2.7	6 20.0 21.4 4.1	1 3.3 10.0 .7	30 20.4
\$2 Million - 2,999,999	1 10.0 4.2 .7	2 20.0 6.1 1.4	4 40.0 7.7 2.7	2 20.0 7.1 1.4	1 10.0 10.0 .7	10 6.8
\$3 Million - 3,999,999	1 12.5 4.2 .7	1 12.5 3.0 .7	6 75.0 11.5 4.1			8 5.4
\$5 Million - 5,999,999		1 14.3 3.0 .7	4 57.1 7.7 2.7	2 28.6 7.1 1.4		7 4.8
Over \$6 Million		3 25.0 9.1 2.0	5 41.7 9.6 3.4	2 16.7 7.1 1.4	2 16.7 20.0 1.4	12 8.2
Column Total	24 16.3	33 22.4	52 35.4	28 19.0	10 6.8	147 100.0

assigned the greatest relative importance to this criteria. Sixty three percent (63.4%) of the respondents with revenue in this range assigned a "very" or "extremely" important rank to this criteria. The respondents from the other revenue ranges are generally normally distributed. The respondents from the \$400,000-\$499,999 sales volume range were skewed to the "somewhat" or "not important" rankings. Twenty five percent, and fifteen percent of the respondents from this range assigned those respective rankings.

Crosstabulation Analysis of Importance of Package in the Control of Inventory

Respondents across all segments are consistent with the sample mean importance ranking for this criteria. In general, more than fifty percent of the respondents from each segment assigned an "extremely" or "very" important ranking to the inventory control criteria. Respondents from the Fast Food and Military segments were skewed to the "extremely" important ranking. Seventy five percent of the Military segment respondents assigned the "extremely" important ranking to the inventory control criteria. Forty five percent (45.5%) of the Fast Food segment respondents assigned the "extremely" important ranking to this criteria. The responses across all segments are skewed to the "very" and "extremely" important ranking for this criteria. Analysis of the inventory control criteria by sales

Crosstabulation

Table 2.32

Type of Operation by Inventory Control

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	5 45.5 11.9 3.3		3 27.3 6.8 2.0	2 18.2 13.3 1.3	1 9.1 25.0 .7	11 7.3
Full Service	3 16.7 7.1 2.0	6 33.3 13.0 4.0	5 27.8 11.4 3.3	3 16.7 20.0 2.0	1 5.6 25.0 .7	18 11.9
Commercial Cafe	1 20.0 2.4 .7	3 60.0 6.5 2.0		1 20.0 6.7 .7		5 3.3
Lodging	1 33.3 2.4 .7	1 33.3 2.2 .7	1 33.3 2.3 .7			3 2.0
Business & Industry	3 16.7 7.1 2.0	6 33.3 13.0 4.0	8 44.4 18.2 5.3	1 5.6 6.7 .7		18 11.9
Hospital/ Nursing	10 21.7 23.8 6.6	18 39.1 39.1 11.9	11 23.9 25.0 7.3	6 13.0 40.0 4.0	1 2.2 25.0 .7	46 30.5
College/ University	9 25.7 21.4 6.0	9 25.7 19.6 6.0	15 42.9 34.1 9.9	2 5.7 13.3 1.3		35 23.2
Deli					1 100.0 25.0 .7	1 .7
Primary/ Secondary		1 100.0 2.2 .7				1 .7
Catering	1 100.0 2.4 .7					1 .7
Military	9 75.0 21.4 6.0	2 16.7 4.3 1.3	1 8.3 2.3 .7			12 7.9
Column Total	42 27.8	46 30.5	44 29.1	15 9.9	4 2.6	151 100.0

Crosstabulation

Table 2.33

Annual Sales Volume by Inventory Control

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	5 26.3 12.8 3.4	9 47.4 19.1 6.1	4 21.1 9.3 2.7		1 5.3 25.0 .7	19 12.8
\$300,00 - 399,999	3 25.0 7.7 2.0	4 33.3 8.5 2.7	3 25.0 7.0 2.0	1 8.3 6.7 .7	1 8.4 25.0 .7	12 8.1
\$400,000 - 499,999	5 25.0 12.8 3.4	2 10.0 4.3 1.4	6 30.0 14.0 4.1	6 30.0 40.0 4.1	1 5.0 25.0 .7	20 13.5
\$500,000 - 599,999	2 50.0 5.1 1.4		1 25.0 2.3 .7	1 25.0 6.7 .7		4 2.7
\$600,000 - 799,999	7 38.9 17.9 4.7	5 27.8 10.6 3.4	5 27.8 11.6 3.4	1 5.6 6.7 .7		18 12.2
\$800,000 - 999,999	2 25.0 5.1 1.4	4 50.0 8.5 2.7	1 12.5 2.3 .7	1 12.5 6.7 .7		8 5.4
\$1 Million - 1,999,999	11 36.7 28.2 7.4	7 23.3 14.9 4.7	7 23.3 16.3 4.7	5 16.7 33.3 3.4		30 20.3
\$2 Million - 2,999,999	2 20.0 5.1 1.4	4 40.0 8.5 2.7	3 30.0 7.0 2.0		1 10.0 25.0 .7	10 6.8
\$3 Million - 3,999,999		4 50.0 8.5 2.7	4 50.0 9.3 2.7			8 5.4
\$5 Million - 5,999,999	1 14.3 2.6 .7	3 42.9 6.4 2.0	3 42.9 7.0 2.0			7 4.7
Over \$6 Million	1 8.3 2.6 .7	5 41.7 10.6 3.4	6 50.0 14.0 4.1			12 8.1
Column Total	39 26.4	47 31.8	43 29.1	15 10.1	4 2.7	148 100.0

volume indicates consistency with both sample mean ranking and the segment specific analysis for this criteria. One sales volume category is more normally distributed than the others. Thirty five percent of the respondents from the \$400,000-\$499,999 sales volume range, assigned either a "somewhat" important or "not important" ranking. An equivalent percentage (in this category) assigned either an "extremely" or "very" important ranking to this criteria.

Crosstabulation Analysis of Importance of Cost in Package Purchasing Criteria

The cost dimension of the package purchase decision was generally evaluated as an "extremely" or "very" important criteria. A significant percentage of operators from each segment assigned the "extremely" or "very" important ranking. One hundred percent of the respondents from the Lodging segment assigned the "extremely" or "very" important to the cost criteria. Ninety one percent (91.7%) of respondents from the Military segment assigned the "extremely" or "very" important ranking to this criteria. All segments were consistent with the sample mean ranking of the cost criteria. Foodservice operators assign a high relative degree of importance to this criteria.

Operator ranking of the cost criteria, across sales volume, is consistent with both the segment specific data and the sample

Table 2.34

Type of Operation by Cost

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	4 36.4 6.7 2.7	3 27.3 5.9 2.0	3 27.3 8.8 2.0	1 9.1 25.0 .7		11 7.3
Full Service	6 33.3 10.0 4.0	7 38.9 13.7 4.7	5 27.8 14.7 3.3			18 12.0
Commercial Cafe	2 40.0 3.3 1.3	2 40.0 3.9 1.3	1 20.0 2.9 .7			5 3.3
Lodging	1 33.3 1.7 .7	2 66.7 3.9 1.3				3 2.0
Business & Industry	6 33.3 10.0 4.0	8 44.4 15.7 5.3	4 22.2 11.8 2.7			18 12.0
Hospital/ Nursing	18 39.1 30.0 12.0	15 32.6 29.4 10.0	12 26.1 35.3 8.0	1 2.2 25.0 .7		46 30.7
College/ University	12 35.3 20.0 8.0	12 35.3 23.5 8.0	8 23.5 23.5 5.3	2 5.9 50.0 1.3		34 22.7
Deli					1 100.0 100.0 .7	1 .7
Primary/ Secondary	1 100.0 1.7 .7					1 .7
Catering	1 100.0 1.7 .7					1 .7
Military	9 75.0 15.0 6.0	2 16.7 3.9 1.3	1 8.3 2.9 .7			12 8.0
Column Total	60 40.0	51 34.0	34 22.7	4 2.7	1 .7	150 100.0

Crosstabulation

Table 2.35

Annual Sales Volume by Cost

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	8 42.1 14.0 5.4	6 31.6 11.5 4.1	3 15.8 9.1 2.0	1 5.3 25.0 .7	1 5.3 100.0 .7	19 12.9
\$300,000 - 399,999	2 16.7 3.5 1.4	4 33.3 7.7 2.7	6 50.0 18.2 4.1			12 8.2
\$400,000 - 499,999	8 40.0 14.0 5.4	6 30.0 11.5 4.1	6 30.0 18.2 4.1			20 13.6
\$500,000 - 599,999	3 75.0 5.3 2.0	1 25.0 1.9 .7				4 2.7
\$600,000 - 799,999	7 38.9 12.3 4.8	9 50.0 17.3 6.1	2 11.1 6.1 1.4			18 12.2
\$800,000 - 999,999	4 50.0 7.0 2.7	2 25.0 3.8 1.4	2 25.0 6.1 1.4			8 5.4
\$1 Million - 1,999,999	18 60.0 31.6 12.2	7 23.3 13.5 4.8	3 10.0 9.1 2.0	2 6.7 50.0 1.4		30 20.4
\$2 Million - 2,999,999	1 10.0 1.8 .7	3 30.0 5.8 2.0	5 50.0 15.2 3.4	1 10.0 25.0 .7		10 6.8
\$3 Million - 3,999,999	2 25.0 3.5 1.4	5 62.5 9.6 3.4	1 12.5 3.0 .7			8 5.4
\$5 Million - 5,999,999		4 66.7 7.7 2.7	2 33.3 6.1 1.4			6 4.1
Over \$6 Million	4 33.3 7.0 2.7	5 41.7 9.6 3.4	3 25.0 9.1 2.0			12 8.2
Column Total	57 38.8	52 35.4	33 22.4	4 2.7	1 .7	147 100.0

mean ranking. Analysis of this criteria by annual sales volume, yields little additional insight into the importance of this criteria in the foodservice purchasing decision.

Crosstabulation Analysis of Importance of Company Specifications in the Package Purchasing Decision

Segment specific data for this criteria, is generally normally distributed and consistent with the sample mean rank data. Three segments, Fast Food and operators from the Business and Industry and Lodging segments assigned a higher relative importance to this criteria. Forty five percent (45.5%) of the Fast Food operators assigned the "very" or "extremely" important ranking to this criteria. Forty four percent (44.4%) of the respondents from the Business and Industry segment assigned an "extremely" or "very" important ranking to the specification criteria. The segment with the highest percentage of respondents assigning the higher rankings was the Lodging segment. Sixty six percent (66.6%) of the respondents felt the compliance of the package to company specification was "extremely" or "very" important.

Analysis of the data across the sales volume ranges yields insight similar to the segment specific data. One sales volume range assigned decidedly low importance ranking to this criteria. Sixty five percent of the respondents from the \$400,000-\$499,999

Table 2.36

Type of Operation by Company Specifications

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	2 18.2 7.4 1.3	3 27.3 8.3 2.0	3 27.3 5.6 2.0		3 27.3 30.0 2.0	11 7.3
Full Service	3 16.7 11.1 2.0	3 16.7 8.3 2.0	6 33.3 11.1 4.0	5 27.8 20.8 3.3	1 5.6 10.0 .7	18 11.9
Commercial Cafe	1 20.0 3.7 .7	1 20.0 2.8 .7	1 20.0 1.9 .7	1 20.0 4.2 .7	1 20.0 10.0 .7	5 3.3
Lodging	1 33.3 3.7 .7	1 33.3 2.8 .7	1 33.3 1.9 .7			3 2.0
Business & Industry	4 22.2 14.8 2.6	4 22.2 11.1 2.6	9 50.0 16.7 6.0	1 5.6 4.2 .7		18 11.9
Hospital/ Nursing	6 13.0 22.2 4.0	13 28.3 36.1 8.6	16 34.8 29.6 10.6	8 17.4 33.3 5.3	3 6.5 30.0 2.0	46 30.5
College/ University	6 17.1 22.2 4.0	10 28.6 27.8 6.6	11 31.4 20.4 7.3	7 20.0 29.2 4.6	1 2.9 10.0 .7	35 23.2
Deli					1 100.0 10.0 .7	1 .7
Primary/ Secondary			1 100.0 1.9 .7			1 .7
Catering		1 100.0 2.8 .7				1 .7
Military	4 33.3 14.8 2.6		6 50.0 11.1 4.0	2 16.7 8.3 1.3		12 7.9
Column Total	27 17.9	36 23.8	54 35.8	24 15.9	10 6.6	151 100.0

Table 2.37

Annual Sales Volume by Company Specifications

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	1 5.3 4.2 .7	6 31.6 16.2 4.1	9 47.4 17.0 6.1	1 5.3 4.2 .7	2 10.5 20.0 1.4	19 12.8
\$300,000 - 399,999		3 25.0 8.1 2.0	8 66.7 15.1 5.4		1 8.3 10.0 .7	12 8.1
\$400,000 - 499,999	2 10.0 8.3 1.4	3 15.0 8.1 2.0	2 10.0 3.8 1.4	9 45.0 37.5 6.1	4 20.0 40.0 2.7	20 13.5
\$500,000 - 599,999	2 50.0 8.3 1.4			2 50.0 8.3 1.4		4 2.7
\$600,000 - 799,999	3 16.7 12.5 2.0	7 38.9 18.9 4.7	6 33.3 11.3 4.1	1 5.6 4.2 .7	1 5.6 10.0 .7	18 12.2
\$800,000 - 999,999	1 12.5 4.2 .7	2 25.0 5.4 1.4	3 37.5 5.7 2.0	2 25.0 8.3 1.4		8 5.4
\$1 Million - 1,999,999	11 36.7 45.8 7.4	4 13.3 10.8 2.7	10 33.3 18.9 6.8	4 13.3 16.7 2.7	1 3.3 10.0 .7	30 20.3
\$2 Million - 2,999,999		2 20.0 5.4 1.4	5 50.0 9.4 3.4	2 20.0 8.3 1.4	1 10.0 10.0 .7	10 6.8
\$3 Million - 3,999,999		5 62.5 13.5 3.4	2 25.0 3.8 1.4	1 12.5 4.2 .7		8 5.4
\$5 Million - 5,999,999	1 14.3 4.2 .7	1 14.3 2.7 .7	3 42.9 5.7 2.0	2 28.6 8.3 1.4		7 4.7
Over \$6 Million	3 25.0 12.5 2.0	4 33.3 10.8 2.7	5 41.7 9.4 3.4			12 8.1
Column Total	24 16.2	37 25.0	53 35.8	24 16.2	10 6.8	148 100.0

range assigned "somewhat" or "not important" rankings to this criteria. In general larger volume operations assigned a higher importance ranking to this criteria.

Crosstabulation Analysis of Importance of Space Occupied by
Package Refuse

The data for this criteria is generally normally distributed within each of the segments. The responses were generally skewed to the less important rankings. Only one segment, Military, had more than 45% of the respondents assign "very" or "extremely" important rankings to this criteria. Fifty percent of the Military segment respondents assigned the higher importance rankings to this criteria.

Respondents with sales volumes in the \$600,000-\$799,999, the \$1 million-\$1,999,999 and the \$2 million-\$2,999,999 ranges were the most sensitive to the importance of this criteria. Seventy percent of the responses in the \$2 million-\$2,999,999 range assigned an importance rank of "extremely" or "very" important to this criteria. Forty four percent (44.5%) of the respondents from the \$600,000-\$799,999 range, and forty percent of the \$1 million-\$1,999,999 respondents, assigned the higher importance rankings.

Crosstabulation

Table 2.38

Type of Operation by Package Refuse

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	2 18.2 9.5 1.3		5 45.5 8.3 3.3	3 27.3 9.1 2.0	1 9.1 14.3 .7	11 7.3
Full Service	5 27.8 23.8 3.3	3 16.7 10.3 2.0	5 27.8 8.3 3.3	4 22.2 12.1 2.7	1 5.6 14.3 .7	18 12.0
Commercial Cafe		2 40.0 6.9 1.3	3 60.0 5.0 2.0			5 3.3
Lodging		1 33.3 3.4 .7	2 66.7 3.3 1.3			3 2.0
Business & Industry	2 11.8 9.5 1.3	4 23.5 13.8 2.7	6 35.3 10.0 4.0	5 29.4 15.2 3.3		17 11.3
Hospital/ Nursing	6 13.0 28.6 4.0	11 23.9 37.9 7.3	16 34.8 26.7 10.7	11 23.9 33.3 7.3	2 4.3 28.6 1.3	46 30.7
College/ University	2 13.0 9.5 1.3	6 17.1 20.7 4.0	17 48.6 28.3 11.3	8 22.9 24.2 5.3	2 5.7 28.6 1.3	35 23.3
Deli					1 100.0 14.3 .7	1 .7
Primary/ Secondary			1 100.0 1.7 .7			1 .7
Catering			1 100.0 1.7 .7			1 .7
Military	4 33.3 19.0 2.7	2 16.7 6.9 1.3	4 33.3 6.7 2.7	2 16.7 6.1 1.3		12 8.0
Column Total	21 14.0	29 19.3	60 40.0	33 22.0	7 4.7	150 100.0

Crosstabulation

Table 2.39

Annual Sales Volume by Package Refuse

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	4 21.1 20.0 2.7	3 15.8 10.3 2.0	8 42.1 13.6 5.4	3 15.8 9.4 2.0	1 5.3 14.3 .7	19 12.9
\$300,000 - 399,999	1 9.1 5.0 .7	2 18.2 6.9 1.4	3 27.3 5.1 2.0	3 27.3 9.4 2.0	2 18.2 28.6 1.4	11 7.5
\$400,000 - 499,999	3 15.0 15.0 2.0	1 5.0 3.4 .7	5 25.0 8.5 3.4	10 50.0 31.3 6.8	1 5.0 14.3 .7	20 13.6
\$500,000 - 599,999	1 25.0 5.0 .7		2 50.0 3.4 1.4	1 25.0 3.1 .7		4 2.7
\$600,000 - 799,999	3 16.7 15.0 2.0	5 27.8 17.2 3.4	9 50.0 15.3 6.1	1 5.6 3.1 .7		18 12.2
\$800,000 - 999,999	1 12.5 5.0 .7	1 12.5 3.4 .7	2 25.0 3.4 1.4	4 50.0 12.5 2.7		8 5.4
\$1 Million - 1,999,999	6 20.0 30.0 4.1	6 20.0 20.7 4.1	12 40.0 20.3 8.2	4 13.3 12.5 2.7	2 6.7 28.6 1.4	30 20.4
\$2 Million - 2,999,999	1 10.0 5.0 .7	6 60.0 20.7 4.1	3 30.0 5.1 2.0			10 6.8
\$3 Million - 3,999,999		2 25.0 6.9 1.4	5 62.5 8.5 3.4	1 12.5 3.1 .7		8 5.4
\$5 Million - 5,999,999		2 28.6 6.9 1.4	3 42.9 5.1 2.0	2 28.6 6.3 1.4		7 4.8
Over \$6 Million		1 8.3 3.4 .7	7 58.3 11.9 4.8	3 25.0 9.4 2.0	1 8.3 14.3 .7	12 8.2
Column Total	20 13.6	29 19.7	59 40.1	32 21.8	7 4.8	147 100.0

Crosstabulation Analysis of Importance of Ability to Recycle Package

Only one segment had a significantly high percentage of respondents assign "extremely" or "very" important ranking to this criteria. Sixty percent of the Fast Food segment responses assigned the "extremely" or "very" important rankings. This is the only segment reflecting any inconsistency with the sample mean ranking for this criteria. In general, respondents across all other segments assigned lower importance ranking to the ability of the package to be recycled.

Analysis of this criteria across sales volume yields only one revenue range ranking it with high importance. Fifty two percent (52.9%) of the respondents in the \$100,000-\$299,999 revenue range assigned "extremely" or "very" important ranking to this criteria. The data across all volume ranges is generally normally distributed and consistent with the sample mean ranking of this criteria.

Summary of Crosstabulation Statistics for Each Packaging Criteria by Foodservice Operator Segment

Table 2.42 presents a summary of importance ranking of each criteria by operator segment. The goal of this table is to simplify the criteria which appears to be "most" important within

Crosstabulation

Table 2.40

Type of Operation by Ability to Recycle Package

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
Fast Food	3 30.0 23.1 2.1	3 30.0 9.7 2.1	2 20.0 5.0 1.4	1 10.0 2.2 .7	1 10.0 5.9 .7	10 6.8
Full Service	2 11.1 15.4 1.4	2 11.1 6.5 1.4	5 27.8 12.5 3.4	7 38.9 15.6 4.8	2 11.1 11.8 1.4	18 12.3
Commercial Cafe	1 20.0 7.7 .7	1 20.0 3.2 .7		2 40.0 4.4 1.4	1 20.0 5.9 .7	5 3.4
Lodging			1 33.3 2.5 .7	1 33.3 2.2 .7	1 33.3 5.9 .7	3 2.1
Business & Industry	1 5.9 7.7 .7	4 23.5 12.9 2.7	6 35.3 15.0 4.1	5 29.4 11.1 3.4	1 5.9 5.9 .7	17 11.6
Hospital/ Nursing	3 6.7 23.1 2.1	9 20.0 29.0 6.2	14 31.1 35.0 9.6	13 28.9 28.9 8.9	6 13.3 35.3 4.1	45 30.8
College/ University	2 5.9 15.4 1.4	8 23.5 25.8 5.5	9 26.5 22.5 6.2	11 32.4 24.4 7.5	4 11.8 23.5 2.7	34 23.3
Deli					1 100.0 5.9 .7	1 .7
Primary/ Secondary			1 100.0 2.5 .7			1 .7
Catering				1 100.0 2.2 .7		1 .7
Military	1 9.1 7.7 .7	4 36.4 12.9 2.7	2 18.2 5.0 1.4	4 36.4 8.9 2.7		11 7.5
Column Total	13 8.9	31 21.2	40 27.4	45 30.8	17 11.6	146 100.0

Crosstabulation

Table 2.41

Annual Sales Volume by Ability to Recycle Package

Count Row Pct Col Pct Tot Pct	Extremely	Very	Important	Somewhat	Not Important	Row Total
\$100,000 - 299,999	3 17.6 27.3 2.1	6 35.3 19.4 4.2	3 17.6 7.5 2.1	4 23.5 9.1 2.8	1 5.9 5.9 .7	17 11.9
\$300,000 - 399,999		2 18.2 6.5 1.4	5 45.5 12.5 3.5	3 27.3 6.8 2.1	1 9.1 5.9 .7	11 7.7
\$400,000 - 499,999		2 10.0 6.5 1.4	6 30.0 15.0 4.2	8 40.0 18.2 5.6	4 20.0 23.5 2.8	20 14.0
\$500,000 - 599,999		1 25.0 3.2 .7	2 50.0 5.0 1.4		1 25.0 5.9 .7	4 2.8
\$600,000 - 799,999	3 16.7 27.3 2.1	5 27.8 16.1 3.5	3 16.7 7.5 2.1	7 38.9 15.9 4.9		18 12.6
\$800,000 - 999,999	1 12.5 9.1 .7	2 25.0 6.5 1.4		4 50.0 9.1 2.8	1 12.5 5.9 .7	8 5.6
\$1 Million - 1,999,999	4 14.3 36.4 2.8	6 21.4 19.4 4.2	5 17.9 12.5 3.5	9 32.1 20.5 6.3	4 14.3 23.5 2.8	28 19.6
\$2 Million - 2,999,999		3 30.0 9.7 2.1	4 40.0 10.0 2.8	1 10.0 2.3 .7	2 20.0 11.8 1.4	10 7.0
\$3 Million - 3,999,999		3 37.5 9.7 2.1	5 62.5 12.5 3.5			8 5.6
\$5 Million - 5,999,999			4 57.1 10.0 2.8	2 28.6 4.5 1.4	1 14.3 5.9 .7	7 4.9
Over \$6 Million		1 8.3 3.2 .7	3 25.0 7.5 2.1	6 50.0 13.6 4.2	2 16.7 11.8 1.4	12 8.4
Column Total	11 7.7	31 21.7	40 28.0	44 30.8	17 11.9	143 100.0

Table 2.42
Summary of Crosstabulation Analysis By Operator Segment

	Fast Food	Full Service	Comm. Cafe	Lodg- ing	B & I	Hosp. & Nurs.	Coll. & Univ.	Deliv.	Pri. & Sec.	Cater- ing	Mili- tary
Use of Recycled Materials	X							NA	NA	NA	
Control of Waste of Product	X		X	X	X	X	X	NA	NA	NA	X
Efficiency in Storage Space	X	X		X	X	X	X	NA	NA	NA	X
Convenience in Opening								NA	NA	NA	
Convenience in Dispensing					X	X		NA	NA	NA	
Ability to Reseal		X						NA	NA	NA	X
Extended Shelf Life	X	X		X	X	X	X	NA	NA	NA	X
Portion Size		X			X	X	X	NA	NA	NA	X
Preservation of Nutritional Value	X	X			X	X	X	NA	NA	NA	X
Storing and Prep. Information					X	X		NA	NA	NA	X
Inventory Control	X	X	X	X	X	X	X	NA	NA	NA	X
Cost	X	X	X	X	X	X	X	NA	NA	NA	X
Existing Company Specifications	X			X	X		X	NA	NA	NA	
Space Occupied by Package Refuse		X						NA	NA	NA	X
Ability of Package to be Recycled	X							NA	NA	NA	X

each segment. The criteria is indicated to be important if 45% of the respondents indicated an "extremely" or "very" important ranking for the criteria.

Factor Analysis and Factor Model

Factor analysis is a statistical technique which allows the researcher to identify broad based and generalized inter-relationships (communalities) among variables. The SPSS program, available on the RITVAX system, was employed to execute the factor analysis technique. The goal of utilizing this technique is to identify the broader constructs underlying the respondents' package purchasing criteria. Researchers may be familiar with similar techniques such as multidimensional scaling (MDS). Both techniques measure similarity or dissimilarity among sets of variables. MDS is generally employed with distance-like data to plot/measure the degree of similarity or dissimilarity. Factor analysis measures similarity, and groups variables into factors. The relationship between variables is seldom directly observable. Factor analysis allows the researcher to establish linear combinations of the factors that incorporate the variables of interest. (Norusis, 1990)

Tables 2.43, 2.44 and 2.45 reflect a summary of the factor analysis output. Table 2.43 is the "Initial Statistics" phase of the factor analysis process. In this phase factors are extracted

based on the total variance explained by each factor. The factors with eigenvalues greater than 1.0 are extracted for construction of the factor matrix.

Table 2.44 represents the factor matrix. The factor matrix represents the correlation between the factors and the standardized variables. Since these factors are not correlated with each other, the values in the matrix represent coefficients of the factors. Each variable may then be expressed in terms of the factors and respective coefficients. For example, in table 2.44 variable 19A (Use of Recycled Material in the Package) may be expressed in terms of each factor by the following relationship:

$$\text{Use of Recycled Material} = .4544F_1 + .72373F_2 - .12304F_3$$

The factor loadings (coefficient) are the same as the standardized regression coefficients in the multiple regression equation. In the factor equation, the standardized variable is the dependent variable and the factor is the independent variable.

The rotated factor matrix, represented in table 2.45, was established using the varimax method. The varimax method will generally reduce the number of variables with high loadings on a factor. This process allows for easier interpretation of the underlying constructs represented in each factor. Variables with factor loadings with absolute values of .500 or less are not

considered to be principle components of a factor. Table 2.46 is a sorted presentation of table 2.45; all values with an absolute value less than .500 have been deleted.

Table 2.43

Factor Analysis: Initial Statistics
Eigenvalues and Percent of Variance

<u>Factor</u>	<u>Eigenvalue</u>	<u>Percent of Variation</u>	<u>Cum. Percent</u>
1	6.53759	43.6	43.6
2	1.60713	10.7	54.3
3	1.25183	8.3	62.6
4	.94426	6.3	68.9
5	.71696	4.8	73.7
6	.69429	4.6	78.3
7	.65853	4.4	82.7
8	.50339	3.4	86.1
9	.48638	3.2	89.3
10	.42838	2.9	92.2
11	.34228	2.3	94.5
12	.25168	1.7	96.2
13	.24057	1.6	97.8
14	.18828	1.3	99.0
15	.14844	1.0	100.0

Table 2.44
Factor Matrix

<u>Variable</u>	<u>Factor 1</u>	<u>Factor 2</u>	<u>Factor 3</u>
"Use of Recycle Material"	.45440	.72373	-.12304
"Controlling Waste of Product"	.56996	.40949	.39954
"Efficiency in Storage"	.75297	.08844	.06839
"Convenience in Opening"	.72244	-.23250	-.42814
"Convenience in Dispensing"	.73529	-.31228	-.45060
"Ability to Reseal"	.67552	-.19758	-.38468
"Extended Shelf Life"	.68165	-.13393	.00250
"Portion Size"	.67257	-.14882	.11560
"Preservation of Nutritional Value"	.58925	.34338	.02483
"Conveyance of Storage & Prep. Info."	.74537	-.00549	-.03701
"Inventory Control"	.72260	-.18850	.39247
"Cost"	.58907	-.22662	.45488
"Company Specs."	.61816	-.29972	.35401
"Space Occupied by Package Refuse"	.74146	.01610	-.09191
"Ability to Recycle Package"	.54734	.61824	-.16727

Table 2.45
Rotated Factor Matrix

<u>Variable</u>	<u>Factor 1</u>	<u>Factor 2</u>	<u>Factor 3</u>
"Use of Recycle Material"	.11043	-.02693	.85586
"Controlling Waste of Product"	-.05813	.51980	.61530
"Efficiency in Storage"	.40026	.48555	.42837
"Convenience in Opening"	.83543	.19932	.14700
"Convenience in Dispensing"	.88783	.21455	.08330
"Ability to Reseal"	.76332	.19192	.15443
"Extended Shelf Life"	.48040	.45988	.20078
"Portion Size"	.40299	.54147	.17967
"Preservation of Nutritional Value"	.23336	.27729	.57827
"Conveyance of Storage & Prep. Info."	.50127	.43179	.34533
"Inventory Control"	.26059	.78648	.15895
"Cost"	.14696	.76157	.06073
"Company Specs."	.26068	.72743	.01311
"Space Occupied by Package Refuse"	.52836	.38281	.36437
"Ability to Recycle Package"	.23791	.02917	.80767

Table 2.46
Sorted Rotated Factor Matrix

<u>Variable</u>	<u>Factor 1</u>	<u>Factor 2</u>	<u>Factor 3</u>
"Use of Recycled Material"			.85586
"Controlling Waste of Product"		.5190	
"Efficiency in Storage"			
"Convenience in Opening"	.8354		
"Convenience in Dispensing"	.88783		
"Ability to Reseal"	.76332		
"Extended Shelf Life"			
"Portion Size"		.54147	
"Preservation of Nutritional Value"			.57827
"Conveyance of Storage & Prep. Info."	.50127		
"Inventory Control"		.78648	
"Cost"		.76157	
"Company Specs."		.72743	
"Space Occupied by Package Refuse"	.52836		
"Ability to Recycle Package"			.80767

The highly loaded variables for factor 1 include:

convenience in opening, convenience in dispensing, ability to reseal, conveyance of storage and preparation information and space occupied by package refuse. These variables reflect the value added dimensions of packaging attributes. The variables within factor 1 reflect typical considerations in the handling and utilitarian functions of a package. The underlying constructs most likely associated with factor 1 are those dimensions of the package related to the human interaction (handling) with the package and product.

The highly loaded variables for factor 2 include:

controlling waste of product, portion size, inventory control, cost and company specification. These variables would appear to

imply "control" constructs. This may be interpreted as all dimensions of the package purchase decision which are influenced by internal controls established by the operator.

The highly loaded variables for factor 3 are: use of recycled material in package, preservation of nutritional value, ability to recycle package. These variables reflect constructs of "social" or "societal" nature. The package purchase decision incorporates some societal construct for foodservice operators.

Chapter V

Summary, Conclusions and Recommendations

Summary

The research presented in the body of this paper reflects an evaluation of package based purchasing criteria by foodservice operators. To establish this evaluation a survey was developed and distributed to twelve hundred foodservice operators in all fifty states and several U.S. territories. In total, one hundred and sixty responses were obtained reflecting the opinions and evaluation of operators from all fifty states, and all major commercial and non-commercial foodservice segments. A descriptive profile of respondents is presented along with output from more inferential statistical techniques. The inferential techniques have been applied solely to the rank data collected from the survey. This base yielded a broad based perspective of the minimally processed vegetable packaging criteria of greatest importance to specific segments; as well as the construct underlying package purchasing criteria across the industry.

A detailed literature review has been conducted. The goal of the literature review was to connect the foodservice operator, the product, package, and conditions encountered in the distribution environment, in a systemic, quality and customer focussed model. The sheer size and growth potential associated

with serving the foodservice industry, by offering high quality, minimally processed vegetables, is presented in a favorable context.

Conclusions

The central issue underlying the purpose of this study is reflected in the answer to the following questions:

"What packaging considerations; in the purchase of minimally processed vegetables, most influence foodservice operators' purchasing decisions?"

Those package attributes which most influence the purchase decision (determinant attributes) are specific to the market segment in which the operator conducts business (see table 2.42). The factor analysis portion of this research yields unique insight into the underlying constructs most influencing the foodservice package purchasing decision. Factor 1 has been identified as those constructs associated with the human interaction with the package/product. Operators appear to evaluate package effectiveness based on the human interaction ("handling") construct. There are a number of potential reasons for this. The package, with proper design features, may reduce the amount of direct handling required; this in turn would reduce the necessary labor input and may have implications for training and general procedures. Conversely, the addition of attributes

which make the package more difficult to handle complicating the process of human interaction, would most likely be viewed as negative. When designing packages/products for the foodservice market, processors must most heavily weigh the value added characteristics of the package. These value added characteristics include convenience attributes, information attributes and those attributes associated with the package disposal process.

Factor 2 has been identified as those constructs associated with internal controls established by the operator. The package plays a role in cost control, portion control, inventory control and waste control (among others). Operators evaluate those attributes which assist in the internal control criteria as important attributes. Processors must consider the cost and control attributes of the package when developing the product mixes.

Factor 3 has been identified as those constructs associated with social issues or societal values. The attributes most closely linked with factor 3 include the recyclability attributes, source reduction and environmental concerns. Additionally, nutritional preservation is factored into this construct. Factor 3 may take on added importance as more states enact mandatory recycling legislation. This factor may also assume a greater significance in the international marketplace

where social mandates are more frequently legislated and enforced.

Recommendations for Further Study

The principal focus of this paper has been the market based role of the package in a business-to-business purchasing decision. The process of conducting this research has yielded insight into the "gaps" that exist in both the marketing and more technical research for the products and industry of interest. The following recommendations focus on the marketing role of the package for minimally processed vegetables:

- 1) Additional research should attempt to capture more insight into the packaging needs of commercial foodservice operators. The data presented are heavily influenced by non-commercial operators.
- 2) Additional research should attempt to establish a larger sample size and response rate across all segments.
- 3) Further research should be done to establish an attitudinal profile of the foodservice industry. This study has attempted to establish "what" are the packaging attributes influencing foodservice purchasing decisions. The next step might ask, "why?".
- 4) The expansion of the number of ranked criteria may yield additional factors in the factor analysis phase,

and should be considered for further research.

- 5) The factors would most likely change if this study was conducted in the international arena. For example, the recycling variables associated with factor 3 may be rated with higher importance in European countries where recycling is mandated. Consideration should be given to conducting a comparative study between the United States and major international foodservice markets.

In addition to the above recommended market based research; there is an obvious shortage of technical research associated with the use of minimally processed produce in the foodservice environment. The following reflect recommendations for technical packaging research:

- 1) There is little available research on the impact of ambient relative humidity, moisture vapor transmission rate of commonly used films and the transpiration (water loss/gain) of respiring produce.
- 2) Research into the feasibility of cost effective, indicators for temperature control throughout the distribution of the minimally processed products. Currently, distributors use temperature monitors in refrigerated shipping containers. These monitors record the ambient temperature of the trailer.

There is little research available on the effectiveness of

package based indicators of temperature control. Once the package moves to the operator/retail cycle there is no way to know if adequate temperature has been maintained. Two specific types of study might be conducted:

- a) End user acceptance and attitudes toward such systems.
- b) Technical feasibility and evaluation of existing package imbedded monitors.

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Appendix A

School of Food, Hotel and
Travel Management
Department of Graduate Studies
George Eastman Building
Post Office Box 9887
Rochester, New York 14623-0887
716-475-5666 Fax 716-475-5099

March 26, 1992

Dear Foodservice Manager;

Enclosed you will find a survey seeking data on your use and satisfaction with two fresh produce items. The survey is a vital component of the data collection process for my Master's degree thesis. The thesis is a study of the foodservice industry's packaging preferences when purchasing certain fresh or minimally processed vegetables. The research is being conducted in conjunction with the Department of Packaging Science and the School of Food, Hotel and Travel Management at Rochester Institute of Technology. The goal of the survey is to establish a decision matrix to aid suppliers, distributors, grower/shippers and brokers in providing fresh products and packaging that meets your needs.

The survey refers to "Pre-Cut" and "Pre-Shredded" products. These products are fresh produce items such as cabbage, lettuce or onions that have been chopped, shredded, cored or otherwise minimally processed. These products should not be confused with fully processed items (i.e. canned or frozen vegetables). The survey also seeks data related to your use of fresh cabbage heads.

Please take 5-10 minutes to complete the survey and return it in the enclosed return mail envelope. I sincerely appreciate your time and consideration. If you would like a copy of the survey results, please enclose a business card and the results will be forwarded upon completion.

Thank You!!



James Myers
Graduate Student
Dept. of Packaging Science

Annual foodservice Volume: [Please Check One]

- | | |
|---|---|
| a. <input type="checkbox"/> \$100,000 - 299,999 | b. <input type="checkbox"/> \$300,000 - 399,999 |
| c. <input type="checkbox"/> \$400,000 - 499,999 | d. <input type="checkbox"/> \$500,000 - 599,999 |
| e. <input type="checkbox"/> \$600,000 - 799,999 | f. <input type="checkbox"/> \$800,000 - 999,999 |
| g. <input type="checkbox"/> \$1,000,000 - 1,999,999 | h. <input type="checkbox"/> \$2,000,000 - 2,999,999 |
| i. <input type="checkbox"/> \$3,000,000 - 3,999,999 | j. <input type="checkbox"/> \$4,000,000 - 4,999,999 |
| k. <input type="checkbox"/> \$5,000,000 - 5,999,999 | l. <input type="checkbox"/> Over 6 million |

Type of Operation: [Please Check]

- | | |
|--|---|
| a. <input type="checkbox"/> Fast Food Restaurant | b. <input type="checkbox"/> Full Service |
| c. <input type="checkbox"/> Commercial Cafeteria | d. <input type="checkbox"/> Lodging |
| e. <input type="checkbox"/> Business and Industry | f. <input type="checkbox"/> Hospital/Nursing Facility |
| g. <input type="checkbox"/> College/University | h. <input type="checkbox"/> Deli |
| i. <input type="checkbox"/> Primary/Secondary School | j. <input type="checkbox"/> Catering |
| k. <input type="checkbox"/> Military | |

City _____ State: _____ Zip _____

Job Title of Person Completing Survey _____

1. Do you purchase a Pre-shredded Fresh Cabbage Mix?

☐ Yes ☐ No

1a. Please indicate the price you are currently paying for Pre-shredded Fresh Cabbage Mix and the unit size being ordered: (example: 5lb. bag, 10lb. bag, bulk bin, etc.)

Unit _____ Price/Unit _____

2. If you purchase the Pre-shredded Cabbage product; how is it utilized on your menu? Please Check; If you do not purchase pre-shredded cabbage, please check how you would consider using the product if purchased.

<input type="checkbox"/> Coleslaw Mix Side Order	<input type="checkbox"/> Coleslaw Mix Salad Bar
<input type="checkbox"/> Vegetable of the Day	<input type="checkbox"/> Addition to Lettuce Salad Mix
<input type="checkbox"/> House Made Egg Rolls	<input type="checkbox"/> Other [Please Describe]

3. How much Pre-shredded Cabbage do you purchase each week?

<input type="checkbox"/> None	<input type="checkbox"/> 1-50lbs.	<input type="checkbox"/> 50-100lbs.	<input type="checkbox"/> 100-150lbs.
<input type="checkbox"/> 150-200lbs.	<input type="checkbox"/> 200-250lbs.	<input type="checkbox"/> 250-300lbs.	<input type="checkbox"/> 300-350lbs.
<input type="checkbox"/> 350-400lbs.	<input type="checkbox"/> 400-450lbs.	<input type="checkbox"/> 450-500lbs.	<input type="checkbox"/> over 500lbs.

4. Do you purchase Fresh Cabbage Heads in either individual heads, 50 pound cases, bags or other units?

☐ Yes ☐ No

4a. What unit/package size do you normally order when purchasing Fresh Cabbage Heads? [Please check]

<input type="checkbox"/> individual heads	<input type="checkbox"/> Other - please specify
<input type="checkbox"/> 50 lb. Cases	_____
<input type="checkbox"/> 50 lb. Bags	_____

4b. Does the unit size you are currently purchasing best meet your operational needs?

_____Yes

_____No

Please provide any additional information which would yield insight into your answer to (4b). (Why is the unit size sufficient or why it isn't?)

4c. Please check which variety of fresh cabbage you are currently purchasing: [You may check more than one]

Green_____ Red_____ Savoy_____ Other_____

4d. When purchasing Fresh Whole Cabbage Heads, do you prefer to purchase: [check one]

___ heads which have the natural "leafy" outer leaves intact

___ heads which have had all of the "leafy" outer leaves removed ["bald" heads]

4e. Please indicate the price you are paying for Fresh Whole Cabbage Heads and the unit size being purchased.

Green:		Red:		Savoy:
Price_____		Price_____		Price_____
Unit_____		Unit_____		Unit_____

5. If you purchase Fresh Whole Cabbage Heads; how is it utilized on your menu? [If you do not purchase Fresh Cabbage, please check how you would consider using the product if purchased].

___ Coleslaw Mix Side Order
___ Vegetable of the Day
___ House Made Egg Rolls

___ Coleslaw Mix Salad Bar
___ Addition to Lettuce Salad Mix
___ Other [Please Describe]

6. How many pounds of Fresh Cabbage Heads do you purchase each week?

___ None	___ 1-50lbs.	___ 50-100lbs.	___ 100-150lbs.
___ 150-200lbs.	___ 200-250lbs.	___ 250-300lbs.	___ 300-350lbs.
___ 350-400lbs.	___ 400-450lbs.	___ 450-500lbs.	___ over 500lbs.

7. you purchase Fresh Pre-cut, Peeled or Shredded Fresh Carrots?

_____Yes

_____No

7a. Please check the Fresh Pre-cut Carrot products you are currently purchasing:

___ carrot sticks	___ peeled whole carrots
___ shredded carrots	___ Chinese style [biased cut]
___ peeled baby carrots	___ other [please specify]_____

8. If you purchase **Pre-sliced, Peeled or Shredded Fresh Carrots**; how is the item utilized on your menu? [If you do not purchase Pre-sliced Carrots, please check how you would consider using the product if purchased].

☐ Specialty Carrot Salads
☐ Addition to Salad Bar Salad Mix
☐ Addition to Stir Fry

☐ Addition to Side Salad Mix
☐ Vegetable of the Day
☐ Other [Please Describe]

9. How much **Pre-sliced, Shredded or Peeled Fresh Carrots** do you purchase each week?

<input type="checkbox"/> None	<input type="checkbox"/> 1-50lbs.	<input type="checkbox"/> 50-100lbs.	<input type="checkbox"/> 100-150lbs.
<input type="checkbox"/> 150-200lbs.	<input type="checkbox"/> 200-250lbs.	<input type="checkbox"/> 250-300lbs.	<input type="checkbox"/> 300-350lbs.
<input type="checkbox"/> 350-400lbs.	<input type="checkbox"/> 400-450lbs.	<input type="checkbox"/> 450-500lbs.	<input type="checkbox"/> over 500lbs.

10. When purchasing **Pre-sliced, Pre-shredded fresh vegetables** of any variety, please rate the following product characteristics that influence your decision to purchase:

	<u>Level of Importance</u>				Not Important
	<u>Extremely</u>	<u>Very</u>	<u>Important</u>	<u>Somewhat</u>	
a.) Compliance with specifications	[]	[]	[]	[]	[]
b.) Easy to convert to standardized recipes	[]	[]	[]	[]	[]
c.) Extended shelf life	[]	[]	[]	[]	[]
d.) Color	[]	[]	[]	[]	[]
e.) Flavor	[]	[]	[]	[]	[]
f.) Variety	[]	[]	[]	[]	[]
g.) Growing region	[]	[]	[]	[]	[]
h.) Organically grown	[]	[]	[]	[]	[]
i.) Reduction of packaging waste	[]	[]	[]	[]	[]
j.) Reduction of food waste	[]	[]	[]	[]	[]
k.) Improved packaging options	[]	[]	[]	[]	[]
l.) Potential level of pesticide residue	[]	[]	[]	[]	[]
m.) Nutritional value	[]	[]	[]	[]	[]
n.) Cost	[]	[]	[]	[]	[]
o.) Other (Please Specify)	[]	[]	[]	[]	[]

11. Please rate the following container/package criteria when purchasing food products for your operation:

	<u>Level of Importance</u>				Not Important
	<u>Extremely</u>	<u>Very</u>	<u>Important</u>	<u>Somewhat</u>	
a.) Use of recycled materials in package	[]	[]	[]	[]	[]
b.) Control waste of product	[]	[]	[]	[]	[]
c.) Efficiency in storage space	[]	[]	[]	[]	[]
d.) Convenience in opening	[]	[]	[]	[]	[]
e.) Convenience in dispensing	[]	[]	[]	[]	[]
f.) Ability to reseal	[]	[]	[]	[]	[]
g.) Extended shelf life	[]	[]	[]	[]	[]
h.) Portion size	[]	[]	[]	[]	[]
i.) Preservation of nutritional value of product	[]	[]	[]	[]	[]
j.) Storing and preparation of information	[]	[]	[]	[]	[]
k.) Inventory control	[]	[]	[]	[]	[]
l.) Cost	[]	[]	[]	[]	[]
m.) Existing company specifications	[]	[]	[]	[]	[]
n.) Space occupied by package refuse	[]	[]	[]	[]	[]
o.) Ability of package to be recycled	[]	[]	[]	[]	[]
p.) Other (Please Specify)	[]	[]	[]	[]	[]

12. Additional Comments:

The goal of this survey is to establish a basis for enhancing product quality and packaging performance of fresh produce products used by foodservice operators. Please provide any additional comments you may have related to product quality, shelf life, product use, recipes, packaging problems, storage problems, price or any concerns you have associated with the use of minimally processed fresh carrots, cabbage or coleslaw.

Industry Reviewers of Survey
Job Title and Market Segment

John Urlaub
Owner, Rohrbach Brewing Co.
Fullservice

Jim Bingham
Director, RIT Foodservice
College & University

William Myers
Director, Nutritional Care
Soldiers and Sailors Hospital
Healthcare/Nutrition

Fred Grabowski
Food and Beverage Director
Sheraton Batavia
Lodging

Paul Bartlett
Foodservice Director
Village at Parkridge
Healthcare

Paul Kramer
Foodservice Director
Rochester Riverside Convention
Center
Catering

Richard Marecki
Graduate Chair, RIT
School of Food, Hotel and
Travel Management
Educator

Andrea Wolak
Director of Catering
Serv-Rite Corporation
Catering

Maureen Torrey-Marshall
President, Torrey Farms
Grower Shipper

Ronald Cole
Assistant Professor
School of Hotel, Restaurant &
Institution Management
University of Delaware
Educator



CMI

EQUIPMENT AND ENGINEERING COMPANY

August 30, 1990

Ms. Maureen Marshall
Torrey Farms, Inc.
P.O. Box 187
Elba, N.Y. 14058

Dear Maureen,

Following is list of the equipment needed for your slaw processing line for 5000 lbs. per hour.

- No. 1. Tote Dump: All stainless steel tote dump with hydraulic pump and a 3 HP. 3 phase motor. Lift is provided by 2 hydraulic cylinders, with a water tight start, stop station.
Price-----\$ 8,900.00.
- No. 2. Incline Conveyor: All stainless steel incline conveyor with interlox belt and adjustable legs. It has 3" flights on 18" centers with a 3 phase gear reduced 2 HP. motor. This conveyor holds approximately 37 cubic ft. of product, and comes with a water tight motor start, stop station.
Price----- 10,900.00.
- No. 3. Inspection Belt w/ Platforms & Cabbage Corers: All stainless steel 15' conveyor with 3' inspection belt and four (4) air operated cabbage corers mounted on conveyor, which will either quarter or half the heads and decore them. The standard height is 42" with adjustable legs, and a 2' platform with adjustable legs, stainless steel handrails, and fiberglass grating, standard height is 6". It has a 1 HP. 3 phase motor. This inspection belt has 6 stations.
Price----- 22,300.00.
- No. 4. Feed Conveyor: All stainless steel 13 1/2' conveyor with 14" feed belt mounted on top of the inspection belt. It is run by a 1/2 HP. 3 phase motor.
Price----- 6,300.00.

- No. 5. Waste Conveyor System: All stainless steel waste conveyor mounted under inspection conveyor.
Price----- 4,750.00.
- No. 6. Incline Waste Conveyor: All stainless steel incline conveyor from inspection conveyor to waste disposal area.
Price----- 5,900.00.
- No. 7. Pump & Pump Tank: A 6" food pump with a 5 HP. 3 phase motor, and an all stainless steel frame. A 2' x 3' pump tank with a 4" inlet and a 6" outlet.
Price----- 8,900.00.
- No. 8. Cutters:
Two (2) Urschel Gk cutters for dicing.
Price (each)----- 27,000.00.
One (1) Waterfall cutter for shredding.
Price----- 30,000.00.
- No. 9. Pump Tank Conveyor: Two (2) all stainless steel conveyors on wheels with a 20" wide belt used to transfer product from cutter to pump tank, and for final inspection, with a 1/2 HP. 3 phase motor.
Price (each)----- 4,900.00.
- No. 10. Cooling Tank w/ Refrigeration System: All stainless steel tank 4' x 10', 45" deep, with 3 separate units of 90'coils each, and two 2" drains with valves, and one 6" flange for gravity flow to pump tank, also a scavenger reel w/ cover and a 1/2 HP. 3 phase gear motor and a 25 HP. w/a specially designed outdoor condensing unit for this application.
Price----- 27,600.00.
- No. 11. Chlorinator: A chlorine injection Stranco unit with PH balance.
Price----- 4,900.00.
- Options:
- | | |
|--------------------|-----------|
| Dip Cell----- | 156.00. |
| 720 Preamp----- | 565.00. |
| Flowcell WS----- | 525.00. |
| Recorder Pkg.----- | 1,180.00. |

No. 12. Dewatering Shaker: All stainless steel shaker with a 2' x 4' wide vibrating bed which is run by a 3 phase motor. It includes a stainless steel chute with a 17" x 6 1/2" discharge opening and a decelator.
Price----- 9,800.00.

No. 13. Spinners: Four (4) Bock model FP90 spinner baskets. Stainless steel basket and most of the external surfaces, unlimited cycles per hour. Price includes basket dolly, lift yoke and grid liner. It is timer controlled and self balancing.
Price (each)----- 11,976.00.

Recommended are four (4) extra baskets.
Price (each)----- 2,496.90.

No. 14. Overhead Rail System: All stainless steel overhead rail 15' x 15' with pipe supports from the floor.
Price----- 6,400.00.
Materials used for installing rail is included in the price based on that it is not over 11' from the floor. Extras include a hoist, the price will vary on the type or size needed, or if the rail system is suspended from the ceiling.

No. 15. Automatic Surface Moisture Removing System:
This unit is fully automatic with no spinning or no handling by hand is necessary. It will remove moisture from the product by use of ' high velocity wind tunnels and vacuum systems. It comes complete with a refrigeration unit and coils. This unit is for 5000 lbs. per hour and is approximately 22' L, 10' W, and 11' H. The unit will be sized depending upon capacity needed. It is shipped complete with coils, motor, variable speed drive on the product belt.
Price----- 95,000.00.

If No. 15 is used, No. 13 and 14 are not necessary.

No. 16. Conveyor System to Bagging Tables and Retail Baggers:
All stainless steel conveyor system to the bagging tables and to the retail baggers.
Price (approx.)----- 12,000.00.

- No. 16. Bagging Table: Two (2) all stainless steel two man bagging table 40" x 5'9", 48" in back and 40" minimum height in the front. The table has adjustable foot pads and a sliding tray for bags in the center of the table. Two stainless electronic wash down scales with remote heads and one size filler head with air ram bag holders. A fully integrated weighing system also includes one filter regulator lube per table.
Price (each)----- 7,400.00.
- No. 17. Retail Baggers.
- No. 18. Heat Sealer: Four (4) bag sealers constructed of all stainless and aluminum, mounted on all swivel wheels. Standard sealing length is 16" with a spanker that can be turned on or off. It also includes a water cooled sealing bar and a bag stretcher which will eliminate most of the wrinkles by the seal area, also a vacuum that can be turned on or off.
Price (each)----- 12,900.00.
Price with a coder----- 13,900.00.
- No. 19. Take Away Conveyor: All stainless steel conveyor that will take product from the heat sealer to the packing area.
Price----- 4,900.00.
- No. 20. Packing Conveyor: All stainless steel conveyor with PVC rollers to accumulate bagged or boxed product.
Price----- 3,800.00.
- No. 21. Carton Sealer w/ Coder-3M.
Price (approx.)----- 4,500.00.
- No. 22. Pipe: Installation of the pipe would include your choice of one of the following with all flanges, connectors, and fittings.
100' of white 4" sched. 40 PVC----- 2,100.00.
200' of white 4" sched. 40 PVC----- 2,800.00.
100' of clear 4" sched. 40 PVC----- 4,300.00.
200' of clear 4" sched. 40 PVC----- 6,500.00.

These are individual equipment prices F.O.B. Glencoe, MN.

Installation is based on a time and material basis at \$35.00 per hour, time and a half on weekends and over 8 hrs. per day. Freight is billed at the rate of \$1.25 per mile per load and any extras such as meals and motels. Also not included, are any hookups on plumbing, electrical, water, air, or refrigeration.

Terms are 40% down with your order, 40% prior to shipping, and 20% balance net 30 days.

Delivery would be approximately 14-16 weeks from receipt of your down payment.

Sincerely yours,


Ken Lovell
Sales Manager

CMI/ck

ATTACHMENT 2

COST OF CONTINUOUS DRYING VS. BOCK SPINNERS

4 Spinners @ \$11,976	=	47,904.00
4 Extra baskets @ \$2,496.90	=	9,987.60
Overhead Rail System	=	6,400.00
Hoist (electric)	=	<u>1,000.00</u>
Total		65,291.60
Labor cost 1st year	=	17,680.00
Labor cost 2nd year	=	17,680.00
(figured 2 people 2080 hrs/yr @ \$4.25/hr		<u> </u>
Total		\$100,651.60

CONTINUOUS MOISTURE REMOVAL

Continuous moisture Removal System		95,000.00
Labor cost 1st year	=	.00
Labor cost 2nd year	=	.00
Total		<u> </u>
		\$95,000.00
Difference at end of 2nd year in favor of continuous system	=	5,651.00

ESTIMATED PEOPLE NUMBERS

Tote Dump	1
Work Belt - Corers	4
Inspection belt	6
Clean up & waste person	1
Pump tank conveyors	2
Bagging tables	4
Packaging conveyors	4
Palletizing	1
Take away Pallets	1
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Total	24
 Retail bagger	 3
Packaging	1
Palletizing	1
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Total	5
 Grand total	 29

LABOR COST

29 people X 2080 hrs/person/yr	=	60,320 hrs/yr
60,320 X \$4.25/hr	=	\$256,360.00
40,000 lbs cabbage/day X 5 days X 52 wks	=	10,400,000 lbs
\$256,360 divided by 10,400,000 lbs	=	.0247/lb

ELECTRIC AND AIR REQUIREMENTS

<u>Electric</u>		<u>Air</u>
Tote dump	9 amps	
Incline conveyor	6 amps	
Inspection belt	3 amps	
Feed conveyor	1.5 amps	
Waste conveyor	1.5 amps	
Incline waste conveyor	1.5 amps	
Pump and pump tank	15 amps	
Two Urschells (15 amps ea)	30 amps	
Waterfalls	20 amps ?	
Pump tank conveyors	3 amps	
Cooling tank	78 amps	
Chlorinator	1.5 amps	
Dewatering shaker	3 amps	
Spinners (4 @ 15 amps ea)	60 amps	} optional
Overhead rail systems	3 amps	
Surface moisture system	63 amps	
Conveyor system	3 amps	
Bagging tables	3 amps	5 cfm per table @ 85 psi
Heat sealers	12 amps	25 cfm @ 85 psi
Take away conveyor	1.5 amps	
Packing conveyor	1.5 amps	
Carton sealer	?	
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320 amps		

SUMMARY OF COST

Tote dump	8,900
Incline conveyor	10,900
Inspection belt with cores	22,300
Feed conveyor	6,300
Waste conveyor	4,750
Incline waste conveyor	5,900
Pump and pump tank	8,900
Two Urschell @ 27,000	54,000
Waterfalls	30,000
Pump tank conveyors @ 4,900	9,800
Cooling tank with refrig. system	27,600
Chlorinator	4,900
Flowcell ws.	525
Recorder pkg	1,180
720 preamp	565
Dewatering shaker	9,800
Automatic moisture system	95,000
Conveyor system to bagging	12,000
Two bagging tables @ 7,400	14,000
Four heat sealers @ 12,900	51,600
Take away conveyor	4,900
Packing Conveyor	3,800
Pipe (200 ft of white 4 inch)	2,800
Carton sealer	4,500
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	\$395,720

ATTACHMENT 6

ESTIMATED FREIGH AND INSTALLATION COST

3 loads @ 1.25/mile	=	4,000
6 men for four days	=	12,000
Motel and meals etc.	=	4,000
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Total		\$20,000

These figures are estimates and could be lower, particularly concerning labor and living expenses.