



This is to certify that the

thesis entitled

MANAGERIAL METHODS OF CONTROLLING
PRODUCT QUALITY IN DISTRIBUTION:
DAMAGE MEASUREMENT, ANALYSIS AND CORRECTION

presented by

CARIS JEAN PALMER

has been accepted towards fulfillment
of the requirements for

MS degree in PACKAGING

Major professor

Date April 30, 1991



PLACE IN RETURN BOX to remove this checkout from your record.
TO AVOID FINES return on or before date due.

DATE DUE	DATE DUE	DATE DUE
NOV 02 2001		

MSU is An Affirmative Action/Equal Opportunity Institution

c:\crl\datedue.pm3-p.1

MANAGERIAL METHODS OF CONTROLLING
PRODUCT QUALITY IN DISTRIBUTION:
DAMAGE MEASUREMENT, ANALYSIS, AND CORRECTION

By

Caris Jean Palmer

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

School of Packaging

1991

657-397

ABSTRACT

MANAGERIAL METHODS OF CONTROLLING PRODUCT QUALITY IN DISTRIBUTION: DAMAGE MEASUREMENT, ANALYSIS, AND CORRECTION

By

Caris Jean Palmer

Although firms may estimate how much and what kind of damage their products experience after they leave the factory, most do not have a formalized system of managing their distribution damage. This thesis examines existing management methods for maintaining the quality of products in distribution, based on the analysis of five companies in the office furniture industry. It recommends developing a systematic approach to controlling quality, by setting performance standards, tracking and analyzing conformance, and then upgrading performance levels and reevaluating standards. It also suggests potential benefits of managing damage information, including a reduction in damage, decreases in replacement and overpackaging costs, and improved customer service.

Dedicated to
my best friend Brian.

ACKNOWLEDGEMENTS

I would like to express my gratitude to the members of my committee: Chairperson Dr. Diana Twede and Dr. Gary Burgess, of the School of Packaging, and Dr. David Closs and Dr. Lloyd Rinehart of the School of Business, Department of Marketing and Transportation Administration. I would also like to thank the participating firms, and the representatives who gave their time and input.

Most importantly, I would like to thank the people who helped me complete my degree(s) by offering both financial and emotional support -- my family and friends.

TABLE OF CONTENTS

CHAPTER I - Introduction	1
PURPOSE	5
Packaging	6
CLARIFICATIONS	6
Transit Claims	6
Types of Damage	7
Loss and Damage	7
CHAPTER II - Literature Review	9
TOTAL QUALITY CONTROL	9
THE MODEL	11
PRODUCTION QUALITY	13
Setting Standards	13
Monitoring the Process	14
Analyzing Conformance	15
Corrective Action and Planned Improvements	18
QUALITY MODEL APPLICATIONS	19
QUALITY IN DISTRIBUTION	20
Setting the Standards	22
Monitoring the Process	23
Management of Information	24
Analyzing Conformance	26
Corrective Action and Planned Improvements	27
CHAPTER III - Research Method and Firms Introduced	28
THE CASE RESEARCH METHOD	28
THE CASE SAMPLES	30
THE METHOD OF ANALYSIS	31
CHAPTER IV - Results	32
SETTING STANDARDS	32
MONITORING THE PROCESS	36
ANALYZING CONFORMANCE	46
CORRECTIVE ACTION AND PLANNED IMPROVEMENTS	48
DISCUSSION	54
QUALITY MODEL APPLICATIONS	58
CHAPTER V - Problems and Recommendations	59
RECOMMENDATIONS	63
BENEFITS	69
PACKAGE IMPLICATIONS	72
IN CONCLUSION	74

REFERENCES	75
APPENDICES	78
APPENDIX A	78
APPENDIX B	82
APPENDIX C	84
APPENDIX D	87
APPENDIX E	90

CHAPTER I

INTRODUCTION: THE DAMAGE PROBLEM

Many U.S. firms adopted a new type of "total quality control" system in the 1980's. The trend toward assuring total organizational quality was in response to consumer demands for more reliable products and better service. The success of firms with effective quality strategies is well documented. "The return-on-investment from strong and effective quality programs is providing excellent profitability results . . . demonstrated by substantial increases in market penetration, by major improvements in total productivity, by much lower costs of quality, and by stronger competitive leadership" (Feigenbaum 1988, xxi).

Unfortunately, most companies do not continue to apply these same quality philosophies to their products once they are in the distribution channels. The "control" seems to end when the products leave the factory, and it is typically not known if quality is maintained unless customer complaints are received.

When discussing the many leading companies that have implemented quality processes in production of goods and services, Bingham states that "the challenge of the '90's will be to extend this process into the logistics and distribution functions" (1989). Indeed, the theme for the 1990 Annual Conference of the Council of Logistics Management was "Logistics Quality." The topics ranged from logistics costs to improving services, but no presentations were offered about damage or control of product quality in distribution. The only sessions discussing defects referred to incoming materials or goods in production, not to quality of products after leaving the manufacturer.

A manufacturing firm's distribution channels are made up of wholesalers and retailers who each take ownership of products in turn, as they flow to the end of the channels. When loss or damage occurs or is discovered while a product is in the possession of a channel member who owns the product, its cost is a loss to that firm. Carriers are generally liable if the damage can be attributed to negligence in transit. But generally, the customer firms that unpack the product bear the greatest loss because of the accumulated damage that occurs throughout a distribution channel while the product is concealed by the package.

Distribution damage can represent significant costs to any firm. They include replacement merchandise, wasted resources and profit potential, return transit costs, and overpackaging which may result from misperceptions that insufficient packaging was the reason for the damage.

To Crosby, the cost of quality--or the price of conformance--is generally much less than the cost of non-conformance, or what it costs to fix the problem (1979). There is also the ultimate cost of losing a customer who repeatedly receives damaged merchandise. Although difficult to measure, the cost associated with customer dissatisfaction--from damaged products and longer lead times to get product in good condition to the consumer--is lost sales. This includes "not only the margin lost by not meeting the current sales demand, but . . . the present value of all future contribution to profit foregone by losing a customer" (Lambert 1975, 8). The consumer's perception of quality affects buying decisions, and damaged merchandise gives a buyer a very clear perception of the quality that does not exist.

Cavinato found that, although the costs are significant, the concept of total loss and damage as an element of the firm's logistical system has not been developed for a variety of reasons which are listed below:

1. It represents a burden that often can be shifted onto other firms.

2. Responsibility for loss and damage in a single firm is often fragmented.
3. Performance evaluation and other management information systems rarely measure it in its entirety or even separately in individual logistics components.
4. Management often views loss and damage as a tolerable cost that is not worth reducing or eliminating because the cost of such effort appears greater than the benefit to be received (1975, 6).

If managers had a good understanding of the overall costs, in many cases they would find that the magnitude justifies the need for a system to control product quality during distribution.

In order to control quality, it must first be measured. Most companies subjectively evaluate their distribution damage. Company personnel, warehouses, carriers and customers may all have some notion of the quantity of damage that occurs, and an estimate of its effect on sales. But these numbers can be greatly under- or over-estimated, and are misleading. It is very easy to see why.

"Damage can be a function of such factors as throughput, general housekeeping, the quality and training of management and labor, the type of product, the protective package used, the materials handling system, the number of times that the product is handled, and how it is handled. To say which of these factors is most important and how much damage each one accounts for is extremely difficult" (Robeson 1985).

Further, although many firms do go through some type of quality audit and corrective action after an exceptional

occurrence of damage, most do not have a formal quality system to routinely control the quality of their products in distribution. Even if damage numbers are available as they are in transit claims, they may be simply accounted, with no action to solve the problem. "As William E. Conway said, measurements of productivity are like accident statistics. They tell you that there is a problem, but they don't do anything about accidents" (Deming 1982, iii).

PURPOSE

The purpose of this research was to investigate and compare the current management methods of five companies in one industry for controlling product quality in distribution. The firms' procedures were analyzed in case studies. Each company was examined for how their existing methods conform to the formal quality control model offered in Chapter Two. Such damage management systems were expected to involve setting standards and managing conformance through appraisal and corrective action, including package or handling improvements. This is also discussed in Chapter Two.

In addition, this thesis yields observations and recommendations for managing damage information, which involves collecting and analyzing information on a continual basis. It also seeks to determine the potential benefits of having a comprehensive distribution damage information system.

Packaging

Packaging professionals often occupy the unique position of being indirectly responsible for maintaining the quality of goods as they change ownership and location throughout a marketing system. Packaging is usually the focus of blame for damage in distribution (even though a packaging solution to a damage problem may be the most costly one). The first question that a Packaging expert asks, when confronted by an alleged "damage problem" is, "how much?" and "what kind?" Such questions are the source for realizing a need for a damage information system.

CLARIFICATIONS**Transit Claims**

It is important to note that managing damage information is different than filing transit claims, although the former may include the latter. Managing information about damage that has occurred in the past goes beyond filing claims. A company may do both: someone may analyze the damage and decide to change the packaging, while simultaneously a claim may be filed for the damaged shipment. But they are two separate issues. Filing a claim is a legal response to damage that has already occurred, while analyzing causes and types of damage is done to prevent it from occurring again. In addition, claims are only filed for in-transit damage by the party that owns the goods during shipment, and they may not show the

whole picture:

Claim form analysis is one source of damage information. The number of units and monetary loss can be found in a claim filing. Not caught in this approach is concealed loss and damage that is not detected until after a time period has passed in which a claim can be filed as well as small claims that the firm does not file (Cavinato 1975, 43).

On the other hand, damage management information systems can span the boundaries of the firms in distribution channels who own, handle, and transport a product.

Types of Damage

This thesis did not attempt to compare and contrast types of damage or different types of marketing systems, although they may appear in discussion. The intention was to compare how some similar firms manage information about damage that has occurred.

Loss and Damage

Often the terms "loss" and "damage" are used together. The research in this thesis was limited to products whose value has been reduced by damage at some point in the distribution channel. It did not include merchandise that has disappeared because of theft, counting errors, and other causes of product loss.

CHAPTER II

LITERATURE REVIEW

The abundant literature on quality control addresses ways to improve product quality and reliability. Also common are methods for reducing the costs of controlling quality, either on an organization-wide basis or at a very detailed level. This literature review begins by exploring the philosophy of Total Quality Control. It then discusses the well developed quality concepts pertinent to production and manufacturing, and finally, explores the minimal literature related to damage in distribution.

TOTAL QUALITY CONTROL

In the opening chapter of Total Quality Control, Feigenbaum states that the goal of competitive industry "is to provide a product and service into which quality is designed, built, marketed, and maintained at the most economical costs," while still allowing for full satisfaction of the consumer (1983, 5). This statement is based on the belief that control of quality "must start with identification of customer quality requirements and end only when the product has been placed in the hands of a customer who remains satisfied" (1983, 11). To

achieve this goal, the actions of people, machines, and information must be coordinated through total quality control.

To Feigenbaum,

Total quality control is an effective system for integrating the quality-development, quality-maintenance, and quality-improvement efforts of the various groups in an organization; so as to enable marketing, engineering, production, and service at the most economical levels which allow for full customer satisfaction (1983, 6).

Juran describes how traditional planning for quality, which was delegated to the functional departments, failed to optimize company performance relative to quality. He calls today's process of strategic quality planning, or managing quality on an organizational level "Companywide Quality Management - CWQM" (1988, 6.23). Similar to Feigenbaum's total quality control, this concept begins with broad corporate quality goals and then objectives are "deployed" into specific responsibilities and procedures. He describes quality control as "the regulatory process through which we measure actual quality performance, compare it with quality goals, and act on the difference" (1988, 6.31).

Sinha and Willborn use the phrase "Total Quality Assurance" to suggest that:

. . . total quality control does not usually mean a cradle-to-grave system with regard only to the product life. [It requires] the total involvement of all staff in an organization together with suppliers, distributors, and even customers, in bringing about quality and satisfaction. . . . (1985, 23).

Total quality embraces all functions and activities of the organization. At the uppermost level, it is a policy or a position, and it may be stated in a very broad manner. For example:

"...to provide a product to our customers which satisfies their performance, quality, reliability, and safety requirements at a fair market price. . . ."

Such a goal is oriented to the results the organization would like to achieve. It is not specific as to the means necessary to accomplish goals. Hence, "the deployment process consists of allocating the goals to lower levels of the organization" (Juran 1988, 8.6).

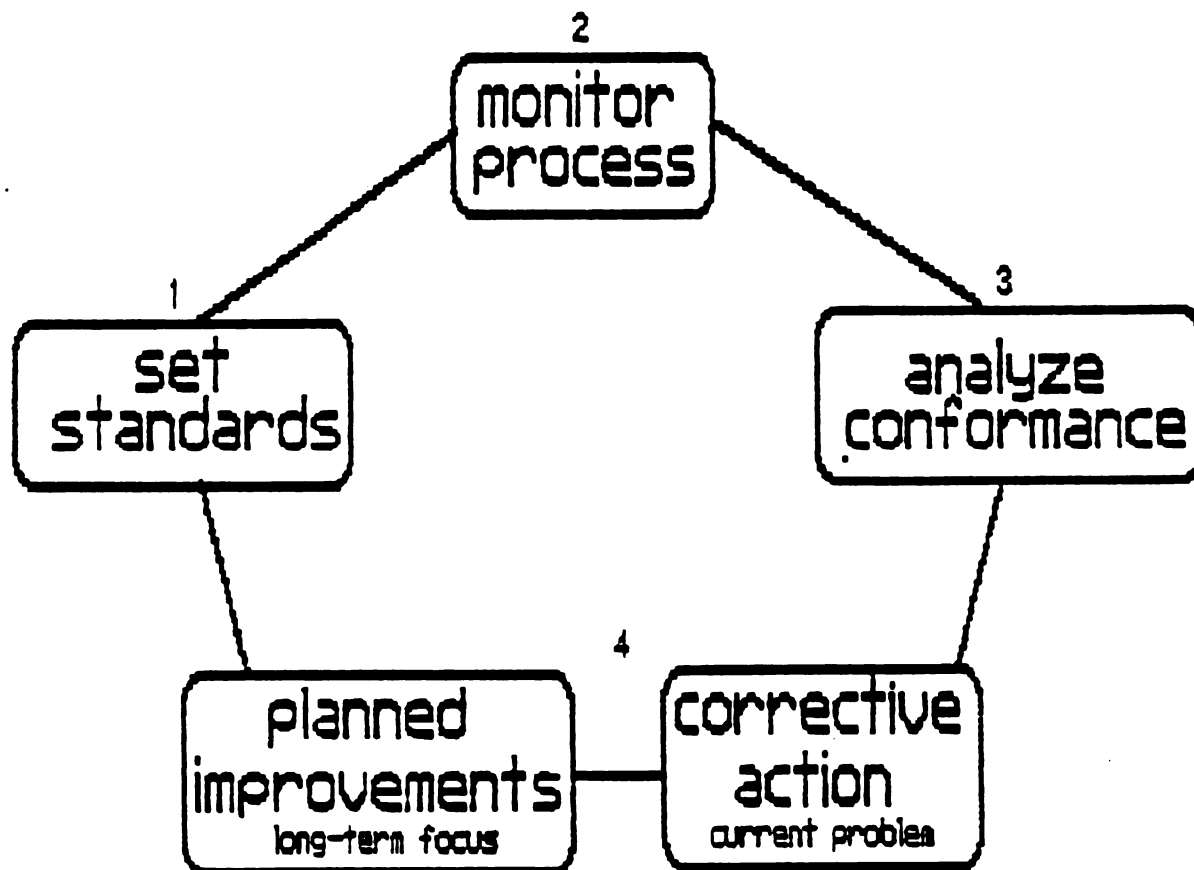
THE MODEL

Many authors propose models to describe the quality deployment process. In "Quality and Control in Logistics: A Process Model," Robert Novak did an extensive literature review of existing control models to form a comprehensive model of his own for controlling logistics functions (1989). Based on his and this author's research, the model shown in Figure 1 will serve as the basis for discussion in this thesis.

Novak finds that there are three basic steps in the models he reviewed:

- (1) the development of goals, standards or plans
- (2) performance measurement or variance analysis
- (3) feedback or corrective action.

figure 1: Quality Model



This model involves setting standards; and then managing conformance to these standards by collecting and analyzing information, and taking corrective actions. This is a closed-loop system, because the process should be continuous. Corrective actions and planned improvements can lead to the setting of new standards.

Functional levels can utilize this system to meet their individual quality goals. Because there are so many functions in a firm, there is a wide array of standards and methods for monitoring conformance due to the diverse goals that need to be met. This will be discussed in more detail later in this chapter.

Most authors in the literature reviewed discuss breaking down broad quality strategies into specific responsibilities for functions. Juran includes supplier relations, manufacturing planning, production, marketing and customer service, quality assurance, and administrative and support functions (1988, 5.1). Feigenbaum lists main-line operations as marketing, engineering, production, industrial relations, finance, and service as well as the quality-control function itself (1983, 13). There is mention of the same, or similar general functions by many authors. Many, like Deming, offer specific methods for achieving quality, and their literature offers the most deployment details in the production arena.

PRODUCTION QUALITY *

Just as corporate quality strategies attempt to guarantee the quality of the overall service a firm offers, quality control in production processes consists of assuring the conformance of product and process to standards. There are many ways to measure performance in the production environment, depending on the process. Feigenbaum offers quite a few examples:

. . .activities for specifying engineering tolerances in user-oriented terms, accelerated test methods for evaluating component and systems reliability, classifying quality characteristics, vendor rating methods, sampling-inspection techniques, process-control techniques, design of quality-control measuring equipment, computer-based quality data processing, gaging systems, standards establishment, product-quality evaluation and rating schemes, application of statistical techniques from X and R charts to designed experiments, and many others (1983, 6).

Many authors illustrate methods to apply quality principles in production. This section explores how each of the quality stages from the model described earlier are deployed in production.

Setting Standards

Crosby defines quality as "conformance to requirements" (1979, 17). Standards must first be set to operationalize this definition. Only then can conformance be measured. Standards

*For the purposes of this thesis, the term "production" refers to all activities involved with the actual fabrication and manufacturing of the product.

in production consist of specifications and tolerance limits, designed to assure performance of machinery and other inputs to the processes. Among the common quality measures used to evaluate shop floor performance are reduction in percent defective (because defects are a symptom of a system out of adjustment), reduction in error rate, and reduction in variation around a target value (Baker 1988, 10.50). These measurements are used to adjust equipment, behaviors, or other aspects of the system that are out of control.

Managing quality in production is much more objective than managing total quality concepts, because once standards are set conformance can be measured. To measure conformance, the processes are monitored by collecting information.

Monitoring the Process

There are two ways to monitor a process. The old-fashioned way is to conduct audits periodically. The other way, which is more appropriate for quality control, is to monitor the process on a continual, on-going basis. Production processes often employ methods that monitor on a regular basis.

The best way to collect information is to utilize a management information system designed to collect, analyze, and report findings. Sinha and Willborn suggest that "the main data for quality assurance are those acquired from the monitoring of

defects and failures and any procedures and other measures for prevention." They list the types of measurements that should be included:

1. Kind of defect.
2. Cause for defect.
3. Location of defects detection.
4. Weight and relative significance of defect.
5. Evaluation of defect.
6. Cost of defect.

They add that "information must be relevant, reliable, current, sufficient, understandable, and optimal in every way, so that decisions are made in a timely, accurate and effective manner" (1985, 479-483).

Analyzing Conformance

"Most decision making in quality control...rests on a base of statistics--defined narrowly as the collection, analysis, and interpretation of data, or more broadly as 'the science of decision making under uncertainty'" (Dudewicz 1988, 23.1). The most common means of reaching quality decisions is regulating all stages of production with statistical process control, which consists of using the basic tools of frequency distributions, control charts, sampling, and tally sheets (Juran 1988, 6.21). Statistical process control and the first two of these tools will be discussed further.

Statistical Process Control (SPC), as defined in the Quality Control Handbook is "the application of statistical techniques for measuring and analyzing the variation in processes."

There are two components of variation in manufacturing processes: a steady component which is inherent in the process--called random variation; and an intermittent component--attributed to assignable causes. Dr. Walter A. Shewhart, of Bell Telephone Laboratories, developed this theory of statistical quality control in the 1920's. "He concluded that assignable causes could be economically discovered and removed, . . .but that random causes could not be economically discovered and could not be removed without making basic changes in the process" (Shainin and Shainin, 1988, 24.3).

A repetitive process or operation will seldom produce exactly the same quality, size, or other measure to be controlled; rather, with each repetition the process will generate variation around some average. Because this variation is usually due to a large number of small, uncontrollable sources, the pattern of variability is often well described by a standard frequency distribution. . . .(Meredith 1987, 526).

Frequency distributions (or histograms) are statistical tools for "presenting numerous data in a form which makes clearer the central tendency and the dispersion along the scale of measurement, as well as the relative frequency of occurrence of the various values" (Dudewicz 1988, 23.12). Frequency histograms are often used for comparison of process capabilities with tolerance limits.

Deming warns, however, that frequency calculations "serve no useful purpose for improvement of a process unless the data

were produced in a state of statistical control." Data points may fall within a normal distribution, but one would not recognize a downward trend, for example, unless the points are plotted on a control chart (1982, 114).

Control Charts aid in distinguishing between the two types of variation, and are used to detect when a process has gone out of control. Shainin and Shainin state that control charts are commonly used to:

1. Attain a state of statistical control.
2. Monitor a process.
3. Determine process capability (1988, 24.6).

Limits are set to determine when an average of measures is too high or low, commonly plus and minus three standard deviations. "Lack of control is indicated by sample averages arising when the process is likely to produce single items outside specification" (Thomas 1965, 155).

Deming suggests that everyone in the company understand statistical reasoning and be able to use elementary statistics. He advocates that the following statistical techniques should be taught to all workers and managers:

1. How to read and construct a histogram
2. How to read a process flow chart
3. How to construct an Ishikawa ("fishbone") chart
4. How to understand a Pareto chart
5. How to read $\bar{x}$ -bar and $\bar{R}$ -bar charts
6. Scatter plots (correlating x and y). (Tribus)

There are many different causes for variation described by statistical distributions and control charts. "The Pareto principle tells us that a few of these causes will have a major effect on the total variation. A few more will have a somewhat lesser effect. Most will have a very small effect" (Shainin and Shainin 1988, 24.5). The Pareto breakdown can be done at virtually any level (from the organization and personnel to the type of defect) due to the endless variety of sources to consider. Because the Pareto principle helps to identify the magnitude of causes, "it helps to assure that resources and attention are concentrated where they will do the most good" (Juran 1988, 6.20).

Corrective Action and Planned Improvements

Once the causes are found, corrective action on the current problem can be carried out and longer-term improvements can be planned, including the review of standards. Examples of corrective actions in production include: changing suppliers due to materials not being "up to spec," adjustment of machinery, and re-training of employees who may have strayed from procedures due to conflicting production performance standards.

QUALITY MODEL APPLICATIONS

Figure 2 summarizes the stages from the Quality Model and relates them to broad corporate and more specific production applications. Applications in distribution will be added in the Results chapter, where this figure will appear again, after a comparison of the cases.

	CORPORATE	PRODUCTION	DISTRIBUTION
SET STANDARDS	Corporate goals Customer service Strategic planning Production rates	Types of defects Levels of acceptance Product specifications Location of damage	
MONITOR PROCESSES	Monthly reports Customer feedback	Inspection Sampling	
ANALYZE CONFORMANCE	Compare reports to goals	SPC - Frequency distributions, control charts	
CORRECTIVE ACTIONS & PLANNED IMPROVEMENT	Project teams Quality circles Education & training Reevaluate goals	Review standards Adjust equipment Education Reevaluate suppliers	

Figure 2: QUALITY MODEL APPLIED TO CORPORATE AND PRODUCTION LEVELS

QUALITY IN DISTRIBUTION

If broad total quality concepts are narrowed down to production and other functions, it seems only natural to apply them to products in distribution. Unfortunately, ". . . too often we go through the whole process of supplying goods and services, all the details of contracting, requirements planning, testing--and yet fail to look at that final item, distribution" (Esterby 1985). Many logistics authors discuss quality in distribution and customer service in terms of completeness of orders, order cycle time, etc. Literature about customer satisfaction also includes product performance once in the hands of the consumer. However, control of damage has generally been neglected in lists of the objectives of distribution quality improvement.

Feigenbaum (1983) and Juran (1988), in their third and fourth editions respectively, do not specifically discuss quality with regard to distribution damage, although Baker recognizes the need:

The need to measure goes beyond the "hardware" departments involved in production; it extends to the "software" departments performing support activities--engineering, accounting, data processing, finance, marketing, material control, etc. While all these departments have quality problems, not all of them have a quantified measure of quality" (1988, 10.50).

Gryna also supports this finding:

Those activities which directly influence the nature of the product (e.g., design, purchase of materials, fabrication, inspection) have received much attention from the quality 'movement.' However, there are other

activities which, though indirectly influencing quality of product, have largely escaped the attention of the quality movement (1988, 21.2).

Gryna calls these functions that are generally lacking in the quality literature "administrative and support activities." Included in administrative activities are finance, personnel, data processing and computers, plant engineering, legal, and other activities. Listed as support functions are shipping, receiving, material, in-process and finished goods storage, traffic, and order filling, among others.

Although these functions seem to have been neglected by the quality movement, Gryna does say that "quality control [itself] has long been practiced in administrative and support activities." He goes on to discuss several tools of diagnosis and how they are identical with those used in product-oriented quality improvement. His discussion examines ways in which quality concepts can be applied to the administrative and support activities, as this thesis seeks to do specifically with distribution damage (1988, 21.2).

As in production or any other function, achieving product quality goals in distribution involves setting standards; managing conformance by developing a system for collecting and analyzing distribution damage information; and taking corrective actions, which may include package, product, transport, or handling changes.

Setting the Standards

To set standards for the control of product quality in distribution, valid physical measures are required. Critical defects must be defined, and threshold levels must be set for judging acceptability limits. The standards should reflect controllable variables: common types and causes of damage, as well as cost associated with damage. The standards should also "reflect both short run and long run performance and they should be reviewed on a periodic basis" (Novak 1989).

The standards should be set by a team which includes representatives from the involved departments: Packaging, Manufacturing, Engineering, Quality Control, Logistics, Material Handling, and Marketing (as well as customers), and any other functions affected by product damage. Since these people will also be the quality management system users, they will be able to tailor the standards to meet their specific needs.

Once standards have been set, methods must be developed for appraising the conformance of products to the standards. Bowersox, when discussing strategic logistical leadership, says that ". . . measurement is the regular and meaningful assessment of performance. If you are not measuring performance in a variety of ways, you are not managing your business" (1990)

Monitoring the Process

Appraising conformance requires that processes be monitored, in order to obtain information for analysis. There are many methods to monitor performance. Some examples follow.

Mitsubishi Electric Corporation, a major Japanese manufacturer and marketer, monitors conformance to standards by using a standardized form. Package and product damage are reported in detail by distribution centers and sales companies within seven days after finding the damage. Using this form, the causes of the damage are investigated in order to improve products, packaging, and distribution practices (Maezawa 1987).

Field audits are another method of investigating damage complaints. Often, when long-distance feedback is the only source of information, data is incomplete and fragmentary or totally wrong because the people relaying the information are not well qualified to evaluate damage. Teams of researchers who inspect routine shipments and/or test shipments can get first-hand information about the specifics of product damage. Although they are valuable for guiding corrective action, field audits are often only performed when a known problem exists, and they do not measure the magnitude of a problem.

To gather both common and abnormal occurrences of damage, a method of appraising distribution quality on a regular basis should be employed. An information system can be used to formally feedback details of shipments. In order to be useful, such a system requires institutionalized detection, measurement, feedback and analysis of damage information.

Management of Information. This is the age of more information for lower cost. There is a wealth of literature about management information systems. There is an increasing emphasis on information systems in logistics, because better information can reduce the cost of customer service. However, although logistics writers discuss the importance of a timely and accurate information system for the effective control of logistics, they do not generally propose tailoring such systems to manage information about distribution damage.

A quality management information system must begin at the first moment of damage detection. At that moment, the most clues to the causes of damage are available. Products may be formally inspected at some point during distribution or the detection may be by chance, such as when a worker handling a product notes a problem.

At the moment that damage has been detected, it should be measured against the standards for product/package quality.

For example: Is the dent larger than the size allowed by the standard? Is the scratch critical? Where is it? Why/how did it happen? In order for the person detecting the problem to be able to generate this kind of data, he/she must be educated to observe and classify damage. This education provides an additional benefit--the sensitivity to damage issues encourages material handling workers to be more careful.

Once damage has been detected, a method is required to feed back the information to those who can analyze the data and correct the causes. Transmission of data can be either electronic, verbal by phone, or by mail. Electronic data interchange (EDI) is the quickest method, tying damage information to other logistical and order information.

In Juran's Quality Control Handbook, Gryna offers actions to improve the quality and promptness of field feedback. Some of his recommendations should be incorporated into any system involving feedback, including distribution damage information:

1. Provide personnel with well-designed data sheets.
2. Provide incentives to encourage adequate feedback.
3. Provide a glossary of terms to improve communication and a mnemonic code number to simplify the data entry and analysis.
4. Provide training in the how and why.
5. Conduct audits of the data feedback process.
6. Make use of modern technology to collect the field information.
7. Make use of modern methods of analysis to provide managers with valid summaries for decision making.
8. Minimize the number of data relay stations.
9. Obtain the operations log (1988, 20.28).

It should be noted that throughout the system, the amount, accuracy, and speed of data collection and transmission depends upon the type of marketing channel. Vertical marketing systems, in which the producing company owns or has a contractual relationship with its channel participants, offer more control over logistical information than do non-vertical marketing systems, in which products change ownership more times.

Analyzing Conformance

There are many opportunities in distribution to measure performance by collecting and analyzing information. For analysis, correlations can be drawn between damage types, stock keeping units, costs, carriers, shipping routes, distribution centers,. . . whatever information is most relevant to making decisions about damage prevention. Reports are prepared which rank products, damage types, carriers, distribution centers, and costs, to illuminate the biggest targets for improvement.

Gryna discusses some tools of diagnosis that could be used for quality improvement in administrative and support functions. These tools are identical to those used in production-oriented quality improvement projects. Among them are:

- Pareto Analysis
- Cause-and-Effect Diagram
- Frequency Distribution and Histogram
- Dissection of a Process

Statistical Control Chart
Sampling (1988, 21.16).

All departments who are in a position to correct the causes of damage should receive reports of data and correlations.

Corrective Action and Planned Improvements

If no corrective actions or planned improvements result from reporting, collecting, and analyzing damage information, the whole purpose of the system is lost. Corrective actions are used to realign actual performance with standards to correct the causes of damage.

Information tends to get less detailed and problems get blurred as they move farther from the problem site. Because of this, the ideal situation is to have the person closest to the activity take corrective action.

Most importantly, corrective action should address the causes of problems, not only the problems themselves. Like defects on the shop floor, distribution damage is a symptom of an underlying problem. . . a quality system out of adjustment (Twede 1989). The elements which may be "out of adjustment" are those which cause the damage: faulty product design, insufficient packaging, and inappropriate methods of handling, storage, and transportation. Until the cause of the problem is found and corrected, damage will continue.

CHAPTER III

RESEARCH METHOD AND FIRMS INTRODUCED

This chapter is organized in the following manner: first, the case research method is discussed; next the sample criteria and selections are described; and last, the method of analysis is explored.

THE CASE RESEARCH METHOD

Product quality in distribution is a largely unresearched topic in both quality and logistics literature. Because this is a relatively new area of theory, this research employed the case study approach. Boulton supports the use of case research in areas of innovation and theory development:

Case research can readily be applied to new areas which require systems thinking. In the earliest periods of research, long before you have developed any theory, data must be gathered in an attempt to describe the territory and raise basic questions about its interrelationships and processes. . . In fact, one might argue that statistical techniques are seldom used to improve theory, only to accept or reject hypotheses.

Boulton argues that large sample research in management practices does little more than determine how many firms are using a practice or technology. Statistical analysis cannot adequately answer questions of "why" or "how" an innovative process was begun, or problems that may have been experienced

along the way. Nor can it adequately explore the most advanced concepts and technologies employed by only a few firms (1985, 3-14).

Case research in marketing theory building is explored by Bonoma, who recommends its use when a researcher seeks to relate phenomena in natural settings.

If properly conducted, research by these methods can provide a "deep understanding (Geertz 1973), a fuller contextual sense of the phenomena under study (Miles 1979), and an explicit provocation toward theory building that often is missing from both simple descriptive work and most cause-and-effect research (van Maanen 1982)" (Bonoma 1985, 201-2).

Furthermore, Bonoma distinguishes between statistical methods of theory disconfirmation and case research in terms of the researcher's goals:

First, the goal of data collection in case research is not quantification or enumeration, but rather (1) description, (2) classification (typology development), (3) theory development, and (4) limited theory testing. In a word, the goal is understanding. Second, most enumeration is of little value to a case researcher. The goal is not the breadth or representativeness of large-n research, but rather the depth of the knowing. The risks of low data integrity are traded for the currency and contextual richness of what is learned (Bonoma 1985, 206).

Case research can yield a rich source of observations. These observations lead to new hypotheses and research questions for further investigation. "Although the case research approach does not permit the rigorous testing of hypotheses because of

the limited sample, the investigation does take place within the domain of a conceptual model" (Twede 1988, 49). This research contrasts some companies' distribution damage control efforts in comparison to the model outlined in Chapter 2.

THE CASE SAMPLES

The five firms chosen are all in the office furniture industry, a convenience sample since the companies are located within close proximity to the researcher. This allowed for personal interviews, rather than phone contacts only. In each case, the key informants were identified by first communicating with a known contact. This led to the mailing of a proposal outlining the purpose of the research, the data requirements including some sample questions, the potential benefits to the firm, and a statement assuring confidentiality regarding the identity of firm and individual names.

The initial phase was followed by a visit to the company during which the questions were asked. Included in the discussions were members from departments who ideally had the best grasp of damage information. Someone from the Packaging department was interviewed at four firms. Other persons interviewed were from the Traffic, Quality, and Claims areas.

The five firms are identified by letters. The firms are not discussed in any particular order, and letters do not

designate any affiliation with company names or any other of the firms' characteristics.

THE METHOD OF ANALYSIS

The analysis of responses from the case study participants was used to deduce generalizations about current methods of monitoring product quality in distribution and functional benefits which are commonly considered. Boulton suggests systematically organizing data to carry out a comparative analysis of data between multiple case studies. "The analysis of similar data over several organizations allows the researcher to identify similarities and differences which leads to the development of new concepts, language and theory" (Boulton, 12-13). This research will follow Boulton's approach.

The following chapter compares and contrasts the case results, with regard to how they adapt to the model offered in Chapter Two. Chapter five follows with conclusions.

CHAPTER IV

RESULTS

This chapter compares and contrasts the five cases. The firms' approaches to distribution damage are compared to the stages of the Quality Model in order to determine if and how the firms operationalize each stage. Each section (relating to each stage in the process) begins with a brief discussion and states how many firms operationalize that stage. Then, examples of individual firms' practices are given, along with limitations of particular methods. The chapter ends with a discussion of other related factors.

SETTING STANDARDS

Two aspects were considered regarding standardizing defects: the level of detail, and the threshold level.

The case firms varied widely on the level of detail contained in their defect standardization. Firm B's "poor packaging" and "damaged in transit" are very broad and ineffective descriptions compared to firm A's "dented" and "broken."

More detail to guide corrective action could be obtained by using terms that refer to location on the product and the

point in the channel that the damage occurred. None of the firms had this much detail in their standards.

Another consideration is the threshold level. Is a scratch considered a nonconformance to standards (damage) when an installer can fix it on site? Or is it a nonconformance only if the scratch is bad enough to necessitate a replacement order? In the former situation, the producing firm may never learn of the damage, and therefore cannot take corrective action to prevent it from occurring on a more widespread level.

One firm sets standards: Firm A. Critical defects are specified and differentiated by firm A to reflect common types of damage. The standards are listed on Field Problem Reports (FPR). FPR's are used for damage communication, shortages, overages, and other delivery and installation problems, and also serve as a replacement order. They are filed by employees of firm A, who oversee problems both at dealerships and at installations, and by customer service representatives when dealers call in with problems.

Codes are used to represent reasons for the report. The "where," "what," and "why" of the problem are included, as are types of damage or "nonconformances." The following is a partial listing of firm A's "nonconformances":

Bent	Broken
Bubbled	Chipped
Closes/opens improperly	Color faded/spots
Cracked	Dents
Gap	Grease/oil
Loose	Misaligned
Noisy/squeaky	Protruding staples/screws
Scratched	Separation
Surface flaw	Too few/many
Torn	Unstable/wobbly
Warped	Wrong color/part/size

However, even if the code for "scratched" is indicated in the column for nonconformance, that is usually the extent of the problem description. Unless the persons passing on the information, and filling out the order, indicate exactly what may have caused the damage, the all-important "how" may not be known.

There are limitations to firm A's standards. Threshold levels are not set for judging acceptability limits. Since the seriousness of the defect is not defined, opinions may be a factor in deciding to report damage information. There are no standards for causes associated with damage, or costs related directly to the damage (other than the cost of the product).

In addition, FPRs may flag problems at dealerships and installations, but not on the production or packaging lines, or at loading docks. Finally, damage standards are only applied to these reports. If one is not filed, damage is not compared to standards, because it might not be known that they exist.

Firms B, C, and E also have field problem/replacement order systems. (Firm D does not). Although they may break the "where" down into areas such as manufacturing, shipping, installing, etc., the most detail allowed for is, for example, "damaged in transit." Therefore, they are not setting standards. The only way of knowing the kind of damage or how and why it happened is if the people ordering and filling out the form note this information in a comments section.

For firm A, having more detailed information means that they are better able to make corrective decisions, and they are able to do it more quickly. After exceptional occurrences of damage, less time is spent obtaining information that could very easily have been noted in the first place. There is not enough detail on the other three firms' forms to be of assistance in tracking problems back to their causes.

Firm E is currently revising its replacement order system to include codes on types of damage and other details (i.e., they are going to set standards). As of this writing, the only distinguishing codes are between "noted" and "concealed" damage. It appears that firm E's new system will be similar to firm A's.

It should be noted that other types of standards may exist. For example, a firm may have a stated (but not managed)

standard of making--and delivering--quality products. If someone in the logistical system notices that a particular product is damaged (i.e., it is not "up to standard"), they may pass this information on to those who can look into the problem. Standards such as these are extremely informal, and they are not very helpful for solving systemic problems, due to the number of ways they can be interpreted.

MONITORING THE PROCESS

As discussed in Chapter II, appraising conformance requires that the processes be monitored in order to obtain information for analysis. All five of the firms monitor their products' quality during distribution in some ways. Replacement orders, audits, and EDI are some of the sources from which the firms get damage information. These and other methods are discussed below, including a listing of the firms that operationalize each particular practice.

It should be noted that the firms do not necessarily differentiate between monitoring and analyzing conformance. It is possible that the same method can be used both to monitor progress, and to analyze specific problem situations. Therefore, the same practice may appear in discussion in both of these two sections.

Product Replacement Orders

Four firms (A, B, C, E) get a good deal of their damage information from replacement orders, which are also called field problem reports. These reports (discussed briefly under SETTING STANDARDS) are filed by dealers and/or customers when a product needs to be replaced due to damage or a number of other reasons. Many times workers will find damage during installation, where it was concealed at the dealer's warehouse or coming off the truck. If it is necessary to fill out a replacement order for damaged product, it is a good opportunity to obtain damage information.

Unfortunately, replacement orders are not always filed when damage occurs. Dealers can replace from stock, make repairs, etc., and the producing firm might never know about the damage. In addition, even if a replacement order is filed because of damaged merchandise, it seldom indicates the true cause in a standardized format, as indicated earlier. There is simply not enough detail.

Damage Audits

Audits can be used as a way of continually monitoring distribution procedures, and they can be useful in evaluating specific problems. They can be conducted on production areas, distribution centers, carriers, dealerships, and installation sites. All of the firms conduct damage audits some times.

Firm A continually monitors loading at the dock, and they conduct formal weekly audits. The auditors check for proper loading, and other routine procedures. Firm A also provides check-off lists with every bill of lading, which serve to flag delivery problems on a regular basis. In addition, they have random field audits conducted by quality assurance once a month, where a team evaluates unloading and installation procedures.

Firms D and E conduct audits on a random basis. Like firm A, the auditors observe packing, loading, and delivery procedures. Firms D and E also have planned audits for shipments and installations of new products, in which they look for circumstances that may require special procedures. Firm C sends an audit team to major installations (over a certain dollar amount) to get a general feeling on whether workers are educated on all aspects of unloading and assembly or not.

All of the firms send audit teams out when checking into a particular problem. This latter way of utilizing audits to obtain further information about a known problem is really a method of analyzing conformance, and it will be discussed later.

Electronic Data Interchange

All five firms have electronic data interchange (EDI) or some type of electronic communication with some dealers. Firm C has major dealers on-line with EDI. By utilizing this real-time customer service system, dealers can place, check the status of, and change orders. The system is evolving so dealers can also include information about damage.

Firms B, D and E also have electronic communication with major dealers. They too are currently investigating methods of utilizing EDI to measure delivery performance. Currently there is no particular format for transmitting damage information (this information is primarily reported in replacement orders), but it is sometimes included in comments or by memo.

Firm A is investigating the implementation of EDI. The firm representative said that it will enable them to have real time visibility to damage and order information across the network. At the present time, only firm A's customer service representatives have access to this information initially. They then pass it on to the quality group, who analyzes and distributes it accordingly.

There are not many limitations with using EDI. For smaller dealers (and suppliers) cost could be a limiting factor. Another constraint could be not using EDI to its fullest potential. If the capabilities are recognized and utilized, EDI can improve, and reduce the cost of, customer service. This is discussed further in Chapter five.

Company Documents

Firm A has a form, called a Corrective Action Report, which can communicate damage information. Employees from any area within the company fill out these forms to identify significant issues that need correction. The system can be used with many problems that exist; it was not designed specifically for damage problems, although it has the potential to identify them. Unfortunately, there are not many of these reports filed by people in the field (the ones who see the damage) because it is extra paperwork. Additionally, the forms are accessible to company employees only, and are not made available to dealers, carriers, etc. Firm A's Corrective Action Report program is about a year old.

Firms D and E have an internal document called a Discrepant Material Report (DMR) which can provide damage information. This form is filled out when damage is noticed in stock situations, or when problems are experienced when shipping on the private fleet. Similarly, firm B has a Return Material

Authorization (RMA) that dealers can use to return damaged product for credit.

At firm E the DMR indicates the product, the location, and what the problem is in general, but not much more (similar to the replacement orders). The report often tells there was concealed damage, but not what kind or how it happened. For firm D, more detail is requested from private fleet drivers who fill out the forms. They indicate the type of damage, where it is on the product, etc. However, this detail (types of nonconformances) is not based on available standards with which to compare damage. It is included as comments from the driver.

Surveys

Some of the firms survey dealers and other customers to collect information for monitoring purposes. Some use it to analyze conformance when confronted with a particular problem. Therefore, surveying is examined under both categories.

Three firms collect information (monitor) by using surveys, either written or verbal. Firm B attempts to monitor damage information by attaching postcards to each order. By using these short surveys, the dealer or customer can rate several different areas, including the condition of the packages/products upon arrival. The postcards are returned to

shipping, and forwarded on to packaging if there are any poor ratings in damage, packaging, etc.

Like firm B, firm A sends service questionnaires with each order requesting information about the condition of the product. Not a lot of detail is requested, except for a rating from "excellent" to "poor," and an area for comments. Therefore, although some damage information may be discovered through this medium, it is very vague.

Each month Firm A conducts phone surveys with warehouse supervisors at dealerships to obtain information on damage, packaging, and related quality problems. The interviewer asks questions following a written form, and notes areas that need attention. The surveys are then compiled for analysis.

Firm D does not send out questionnaires on a regular basis, but conducts surveys when new product lines are introduced and major packaging changes have been made to measure the success of the innovation or change. Firm B also does phone surveys periodically to get information on packaging problems.

Surveys of any kind have limitations placed on them by those being surveyed. Monitoring information by survey is respondent driven. . . information is relayed only if they take the time to respond. The firm B representative estimated that

they only receive ten postcards at the most each month in response.

In addition, information obtained from surveys is very subjective due to a lack of standards. Someone might circle "poor packaging," but might not state why, what particular product was damaged, or how it was damaged. Even if the product and type of damage is indicated, it may be one out of thousands of shipments. For these reasons, it is difficult to know the magnitude of the problems.

Verbal Communication

All five of the firms use anecdotal damage information. However, because it is not solicited either on a periodic or an on-going basis, it is an extremely informal method of monitoring. Each of the firms, however, consider this type of information valuable. One of the case interviewees stated "the company still depends a fair amount on informal communication, and it is the best kind of information sometimes, but you do not get it until it is already a big problem."

Word-of-mouth information can come from dealers and customers, company field representatives, members of industry

organizations, carriers, and anyone that interfaces with the product.

The limitations of verbal communication are the delayed timing and lack of measurement. Often, information is not received until a big problem already exists. Any estimate of damage magnitude depends on the skill of the storyteller. A dealer may call and say that a particular type of damage happens "all the time," when in actuality it is a very small percentage of the time. Therefore, it can be difficult to quantify verbal information to get a real-time measure of the magnitude of a problem.

Another limitation of word-of-mouth communication is that damage information may pass through several people (and their perceptions) before it reaches someone that can use it. By the time it gets there, the information may be ambiguous or misleading. For example, one of the representatives said they have trouble getting accurate information from some dealers' warehouses. The workers' personal opinions and attitudes have a bearing on what, and when damage problems get passed on. If information is not communicated immediately, it may be very vague by the time someone at the dealership, and in turn someone at the manufacturing firm, is informed.

Claims

Generally, none of the case firms process claims for in-transit damage. Except under specific circumstances, the dealer or customer is responsible for filing freight claims with the carrier. However, the manufacturer might get some information about damage from carriers that have had claims filed against them. Information availability varies between carriers, and may depend on the shipper-carrier relationship.

Firms B and D request monthly reports from many of their carriers. Firm D's reports list the amount and status of each claim filed that month, and there are columns for product and damage information. Unfortunately they are usually not detailed enough to suggest corrective action. Carriers may collect information concerning what products were damaged and what happened in general (including shipment-specific details like which terminals, switching yards, or vehicle equipment were used), but the actual type and cause of damage are often missing. Another limitation is that the carriers can pass on information about in-transit damage, but not problems in other areas of the logistical system.

Firm A conducts a carrier phone survey each month to get general damage information and opinions on packaging, procedures, etc.

ANALYZING CONFORMANCE

As stated in Chapter Two, most decision making in quality control is based on statistics. Since the case firms receive fragmented damage information, statistical analysis techniques are not possible because distribution processes are not monitored on a continual basis. Hence, information is obtained as part of the analysis process once problems have already been identified.

All five firms analyze conformance informally. Three practices were discovered: quality reports, audits and surveys.

Quality Reports

One way of analyzing product/package conformance to standards is to prepare reports which rank products, damage types, carriers, distribution centers, and costs, to illuminate the biggest targets for improvement. Correlations can be drawn between the above mentioned, stock keeping units and shipping routes,. . .whatever information is most relevant to making decisions about damage prevention. This process is similar to Pareto Analysis, although Pareto requires formal data gathering to be effective. For the case firms, the only data available for analysis is that which someone has decided to convey. Most of the firms' reports are prepared by their Quality departments.

Firms C and E prepare corporate quality reviews on a quarterly basis. They combine quality issues and highlight trends and particular problems using information gathered from the damage sources listed in MONITORING CONFORMANCE. For firm C, the reviews concentrate on product failure and damaged freight, and they are based on information that is obtained by asking specific questions during a reorder. Firm E's reviews cover all quality issues. Because of this broad scope, other problems (for example, production defects) may outweigh distribution damage each quarter. Both firms C and E use the reports to focus on major problems, and they assign resources and project teams to further analysis.

Similarly, firm D prepares monthly reports based on information received from customer and dealer complaints, replacement orders, and DMRs. The damage reports, which highlight the products that suffered the most damage that month (based on the best information available), trigger investigations into problems.

Firm A uses their surveys (discussed earlier) to compile monthly reports. Then, correlations are drawn to better pinpoint damage. For example, by using the monthly reports, they could determine that some of their east coast dealers had experienced a marked increase in damage to file cabinets that

month. They could then investigate their carriers delivering to the East coast to find out why.

In addition, Firm A can print reports that summarize the Corrective Action Reports, or the Field Problem Reports (replacement orders). The data base can be sorted by any of the categories contained on the forms.

Audits and Surveys

As mentioned in monitoring conformance, audits and surveys are both a common means of finding out about problems, and of quantifying particular problems that the firm is already aware of. All of the cases said they use both practices to further analyze problems they already know about.

CORRECTIVE ACTION AND PLANNED IMPROVEMENTS

Corrective actions should address the causes of problems, not only the problems themselves. For example, damage can result from rough handling during production, handling, transport or storage procedures. But behind that rough handling may be a lack of management, assuring that things are being done correctly.

All five of the firms take corrective actions and plan for improvements. Some of the corrective actions that the firms have taken include forming project teams, making packaging and

product changes, and training employees. These and other actions follow, and they include specific examples.

Project Teams

All of the firms form special project teams for solving some problems. For example, firm A acts upon the corrective action reports discussed under corporate documents by having a committee appoint the necessary people and resources for follow up. The follow up action taken is formalized, and there are standard operating procedures to follow. In a damage situation, teams evaluate various aspects of the distribution environment, asking specific questions about the problem being investigated to find the cause. Some of the corrective actions implemented by project teams follow.

Package Improvement

Packaging changes are often made to solve a damage problem. A solution might be to use stronger materials, change the package altogether, or eliminate the package and blanket-wrap the product (as is commonly done in the office furniture industry). Firm D pointed out that eliminating the package is not a solution in some situations, because customers and dealers can choose to have all products in packages. However, they encourage the use of blanket-wrap.

Firm C had a problem with scratches on the bases of their chairs. Although the scratch could not be seen when the chair was assembled and in place in an office, it could be seen when the carton was unpacked because in the double-pack box, one bottom was facing up. A Japanese distributor for firm C's product considers the nonconformance unacceptable, and notes this on monthly status reports. The solution was to use a returnable rack package to hold the bases, which are individually wrapped in a kraft paper to avoid scratching.

Due to a lack of information about handling capabilities, procedures, etc., it is often assumed that the package is at fault and a change is made, even though that may not be the best solution. This often results in a very expensive package that protects the product no better than the original one did. Additional cost per package is a direct variable expense, and may also increase the cost of solid waste disposal, whereas management corrective actions, like training employees in handling procedures, returns an investment. In addition, due to the lack of an information system, the performance of the new package cannot be measured accurately.

Change in Product

Investigation may reveal that the cause of the damage is due to the inherent fragility of the product. Engineering changes may be one of the corrective actions taken, to make the

product more durable for the distribution environment. In one example, reducing the number of parts in a light fixture not only decreased costs, but reduced the number of parts susceptible to damage.

Establishment of New Procedures

An example of establishing a new procedure is adding an additional inspection point to flag potential problems before they occur, before packaging for instance. The ease of establishing new procedures depends on the severity of the change. Some procedural changes may be very simple to implement. On the other hand, any new procedures can be difficult to establish without the proper planning, education and implementation.

Some of the respondents said that management is often resistant to changing procedures until there is enough documented justification to do so. This documentation is hard to obtain, without first trying the new procedure. Therefore, procedural changes can be difficult corrective actions to take. There can be a massive number of people and steps involved, and it is difficult to get people to change how they do things if they have been doing them one way for a long period of time. It is important to inform employees why things must change, and how the change will be beneficial.

Reevaluation of Standards

Having the same reoccurring problems could mean that standards need to be reevaluated. It is possible that they are too stringent, or too lenient, or that the situation has changed enough to dictate a reevaluation. It also is very possible that workers are operating under conflicting standards. In one example, a particular corrugated box is to be closed with two pieces of tape on each side. However, due to a competing production standard that requires the worker to handle a specific number of pieces per hour, he only puts one piece of tape on each side. This can lead to the box opening in distribution, lending itself to damage. To correct the situation, one or both of the standards must be reevaluated.

Reevaluation of Suppliers and/or Materials

It is possible that damage is due to inputs into the product or package--inventory or materials that do not meet specification. This could affect product/package performance. Investigation might reveal that a supplier is having problems. Corrective actions could be taken to help the supplier overcome any limitations, material specifications could be reevaluated, or a new supplier could be found.

Two of the firm representatives said that they have had problems with materials not meeting specification, or that they have had to set standards for material performance. Like

the example above, where the worker was only using half the amount of tape, the wrong kind of tape can also be a problem. At one firm, the purchasing department found that it could save money buying cheaper tape. They did not realize that this new, less expensive tape was leading to higher damage costs because it had a poor adhesive. Corrective action involved educating purchasing on the necessary qualities of the tape to be used.

Training and Education

Training and education are valuable actions to take in all situations. The more that people are aware of how their work affects other aspects of the company, they will realize why procedures exist. Videos are a common method used to further the education of employees, showing correct procedures and instructing workers on specific tasks. Unfortunately, videos (and training in general) can be time consuming and costly.

Firm C has found that over time, workers stray from standard procedures to take short cuts (again, possibly due to competing goals). They have recently completed making a video to remind workers of a particular packaging process. In this case, a corrugated slip sheet was to be laid on the correct size skid so fabric-covered panels could be stacked on top. However, workers would use any skid, even if it was too small, and panels were getting scratched from hanging over the edge.

Also, they were omitting the corrugated slip sheet, and the bottom panel's fabric was being torn from nails on the skid. Hopefully, reminding the workers of standards, and why they exist, will solve the problem.

Purchase New Equipment

Another corrective action taken is the purchase of equipment. This ranges from buying new hand carts to financing sophisticated loading and unloading equipment. New purchases can prove costly, but justification can often be found in improved efficiency.

DISCUSSION

Problems With Understanding Systemwide Damage

Products change ownership and liability so often in logistical systems that large totals of damage can go unnoticed because single logistical activities may experience small amounts of damage, or what someone feels is "insignificant." One of the case representatives said "there really hasn't been much of a damage problem," though he had no totals for system-wide damage to back up his statement. If total damage is, for example, only two percent of \$100 million in sales, 2 million dollars is being taken from profits!

Dealerships can sometimes replace merchandise through their own warehouses. The manufacturer might not learn about these

replaced (damaged) products until a periodic inventory count or an audit is conducted. There is a lost opportunity when inventory is taken monthly or quarterly because damaged merchandise is lumped into one category, without detailed reports.

Trained workers can make many cosmetic changes and small repairs on office furniture at an installation. Often, these types of problems exist for a long time before they are communicated back to the manufacturer. For example, by trying to cut down on the number of employees needed for an installation, one firm discovered that much of workers' time was spent repairing a scratch that appeared on the same product every time it was shipped. After years of having the same problem occur, the firm was able to look into the problem and take corrective action to avoid the scratch in future shipments.

Truckload versus Less-than-Truckload

All of the firms agreed that more damage seems to occur with less-than-truckload (LTL) shipments than with truckload (TL) carriers (although they had no data to confirm this).

Shipping by truckload offers the opportunity to package differently than is possible with LTL due to the fewer number of times the product is handled and the additional control

over stowage and shipping conditions. For example, office furniture is shipped in conventional corrugated fiberboard shipping containers by LTL carriers, and is often shipped uncartoned and blanket-wrapped by full truckload. This results in lower packaging material purchasing and solid waste costs. Each of the firm representatives mentioned a desire to have more TL shipments.

Handling Capability and Procedures

All of the key informants voiced a concern about the lack of knowledge about dealers' unloading capabilities. Often a shipment will arrive, and the proper unloading equipment is not available.

Firm A gave this example: in New York City many customers and dealers lack a loading dock. Workers must unload the truck at street level and sometimes carry product up several flights of stairs. Since workers are often on a time schedule for deliveries, they unload as quickly as possible. Hence, if there are only two workers, and one is busy bringing freight into the building, the worker outside often drops the package from the back of the truck to the ground (a four to five foot drop).

The firms also expressed concern over material handling workers not being trained in unloading procedures. Warehouse employees at dealerships are often part-time help, not trained due to the short duration of their employment (for example, a student with a summer job). Problems also surface with products that need to be handled in a special way. Even trained employees may not be informed of a particularly fragile or awkward product's handling procedures.

QUALITY MODEL APPLICATIONS

Figure 2 can now be completed. Actual applications discovered from the case firms are included in the Distribution column.

	CORPORATE	PRODUCTION	DISTRIBUTION
SET STANDARDS	Corporate goals Customer service Strategic planning Production rates	Types of defects Levels of acceptance Product specifications Location of damage	Damage types Level of importance Causes of damage
MONITOR PROCESSES	Monthly reports Customer feedback	Inspection Sampling	Replacement orders Audits/Surveys EDI Company documents Verbal communication Carrier claims and reports
ANALYZE CONFORMANCE	Compare reports to goals	SPC - Frequency distributions, control charts	Reports Audits
CORRECTIVE ACTIONS & PLANNED IMPROVEMENT	Project teams Quality circles Education & training Reevaluate goals	Review standards Adjust equipment Education Reevaluate suppliers	Project teams Review standards Purchase equipment Education & training Reevaluate suppliers Package improvements Product improvements New procedures

Figure 3: QUALITY MODEL APPLIED TO CORPORATE, PRODUCTION & DISTRIBUTION LEVELS

CHAPTER V

PROBLEMS AND RECOMMENDATIONS

The purpose of this research was to examine how some companies control the quality of their products in distribution. It was expected that management methods would involve setting standards, and managing conformance through appraisal and corrective action. For the most part, this was found to be true:

One firm sets standards; and all five firms monitor and analyze conformance, and take corrective actions.

However, though all of the firms participate in some stages, none of them have a formal, systematic approach to controlling product quality in distribution. The firms' methods are reactive to damage occurrences. They are not planning for quality in distribution like they plan for it in production.

In this chapter, problems are discussed and recommendations are offered. The primary problem is that quality is not controlled on a formalized basis. Because of (or due to) this, the firms only obtain fragments of the necessary systemwide damage information, and no one has an official responsibility for managing product quality in distribution.

Problem 1: NO FORMAL SYSTEMS EXIST

Although the firms might formalize individual stages, they do not have formal quality systems. They are not consciously controlling their products' quality in distribution as it is controlled in production.

The case firms all have important pieces of a quality system for controlling distribution damage. Some of these pieces are formalized. For example, firm A sets standards to identify types of nonconformances on the product. However, they do not formally operationalize the next stage in the quality system, monitoring. If the form on which the standards are listed is not observed (which is very possible since it is not always filled out when damage occurs), there is nothing to compare actual performance to.

Therefore, it is not beneficial to set standards if conformance to them is not monitored systematically. Likewise, corrective actions are very difficult to take without possessing information that is based on comparisons of actual product/package performance to standards. Taking part in one stage is fruitless without also operationalizing the other three.

In addition, if the system is not formalized, its potential value is not realized. Many people within the firm and

throughout the channel could possess valuable information that they are not transmitting simply because they are not aware that they should. Unless all channel members and carriers are aware of a system (or even stages of a system), and educated to utilize it, information will not be conveyed on a timely or consistent basis, and may not be conveyed at all.

Problem 2: INFORMATION IS FRAGMENTED

Defect data collection on distribution activities at the case firms is done the "old fashioned way," the way it used to be done in production. Then, problems were handled only after they occurred, and the information obtained was not complete enough to make sound corrective action decisions. Today, production processes utilize quality control to continually appraise conformance, and to prevent problems from happening. Distribution processes do not.

Although the case firms have many ways of obtaining information, they are not systematically monitoring their products' quality in distribution. Therefore, they do not have a complete understanding of systemwide damage. Even firms that have many ways of monitoring do not have enough standardized detail to make decisions without taking extra steps to find out the necessary information. They can identify problems, but can not quantify them. If distribution practices followed the lead of those in production, they would

have a view of the total picture. Information--and decisions--would be much more objective than they are now.

Relayed information is fragmented, slow in being transmitted, and not detailed enough. This is because the responsibility for damage is fragmented throughout the company and the distribution channel.

Problem 3: NO ONE IS RESPONSIBLE

At the case firms, no one is officially responsible for managing product quality in distribution. Damage problems are shifted between members of the firm and the channel.

As mentioned in Chapter One, Packaging Professionals often end up being held responsible for solving damage problems since the package is usually the focus of blame for damage. However, because the system is not formalized and information is fragmented, Packaging experts do not get the necessary, detailed answers to the questions of "how much?" and "what kind?" (of damage). Unfortunately, neither does anyone else.

RECOMMENDATIONS**Develop a Formalized, Systematic Approach to Control Product Quality in Distribution.**

The firms should take the stages that they already have partially implemented, and develop a damage management system. Firm A operationalizes each of the four stages from the Quality model. They now need to formalize the stages into a system in which all channel members participate. Firms can follow the Quality model set forth in this thesis. It can be used for formalizing methods of setting standards, monitoring the processes, analyzing conformance and taking corrective actions/planning for improvements.

Ethan Allen has a benchmark formalized system for managing the quality of their furniture throughout distribution. A team sets the standards for product quality (eg. breaks, cracks, upholstery defects, warpage, crushed, missing items, finish defects, etc.), critical locations of damage on the product and in distribution channels, package condition, and handling problems. Product is monitored throughout the distribution channels, and damage information is transmitted by phone and keyed into a database. Products are then ranked by damage frequency as well as by highest cost losses, and corrective actions are taken (Twede).

Formalizing a system will engage the participation of the many people that can offer necessary assistance in maintaining quality in the distribution channel. As participation becomes more synchronized, less money will be spent investigating the causes of damage. . .the information will already be available in a database.

The system should include the participation of dealers and the ultimate consumers where the installation occurs, because this is often where concealed damage is finally discovered. In addition to helping the manufacturing firm obtain damage information, channel members can benefit from being a participant in the quality system. By using guidelines and standards to compare performance, they will be able to control their processes as well.

Give Someone the Responsibility of Managing the System

There is not any one person that alone can control quality in distribution. Driving the quality system should be a team, including someone from Packaging, Traffic, Quality, and Product Engineering. When needed, managers, foremen, carriers and others can be brought in. All of the above have a common goal: to reduce damage. Input from all is necessary when solving logistical damage problems, because alone, each lacks knowledge about the other areas.

There has to be someone to manage the team that manages the system. Members of the above areas have specific responsibilities that could limit them from being the overall controller. Therefore, it is recommended that a Distribution Quality Control (DQC) Manager be appointed, someone who oversees the damage management system and assures functionality and progress. This manager should have contact with all departments involved in distribution operations, as well as channel members and carriers. The DQC Manager could operate under similar formal procedures as the Production Quality Control Manager does.

The DQC Manager should report to Logistics, and his/her position would parallel that of someone responsible for other logistical customer service activities such as order management, warehousing, product support, etc.

The team, under the direction of the DQC Manager, should define its mission and scope of interest. It should set standards for procedures and product quality. If left to the individual functions, conflicting performance goals will result in standards that are difficult for some to comply with. Standards should be simple to understand and follow, then nonconformances will be easy to recognize. Diagrams and graphics can help workers understand procedures, damage types,

and causes of damage without spending too much time reading detailed reports.

After standards are set, the team can then implement methods of monitoring conformance with them. Examples of methods were discussed in Chapter Four. An information system is required to formally feed back details of monitoring to those who can analyze the data and correct causes of damage. In addition, the same methods of monitoring processes and feeding back data should be used to monitor any corrective actions, to see if they improved the situation.

Use Electronic Data Interchange to Facilitate Complete Data Gathering and Transmission.

The communication of information is the vital link that ties the process together. Because EDI can span the boundaries of firms who own, handle and transport the product, it is the quickest method of feedback, and can tie damage information to other logistical information.

EDI can assist in collecting damage information because it facilitates standardizing and formalizes monitoring. It is already commonly being used for other logistical information activities like customer service, order information, delivery status, etc. The opportunity exists to include information about the quality of products throughout the channel and at

delivery. As stated in RESULTS, several firms are already looking into the possibilities of utilizing EDI to transmit, and manage, damage information. Ethan Allen could also benefit by adding EDI to their damage management system. Currently, they transmit data by paper and telephone, and have to spend time with data entry. With EDI, information could be in the system and available for analysis immediately.

The opportunity also exists with EDI to include customer information such as unloading capabilities and special handling restrictions. As discussed, each of the firms voiced a concern about the lack of knowledge in this area. Using EDI, special packing and delivery, or unloading instructions could be included with each order.

Through EDI, damage information can be transmitted to a database. Part of the development process for the database should include defining what kind of information is necessary to make intelligent decisions. Features will vary between firms, but regardless of the actual structure, the database should be capable of manipulating data in many ways, relative to who needs it. Some possibilities for analysis are: frequency of occurrence of a particular product number, damage as a percent of sales, and dealers experiencing the most damage monthly. Analysis methods should help to determine whether the cause of the problem is related to product

quality, handling procedures, transit environment or any other inputs to damage.

One of Cavinato's premises, listed in Chapter One, was that management often views loss and damage as a tolerable cost that is not worth reducing or eliminating because the cost of such effort appears greater than the benefits to be received. However, after the initial implementation costs, EDI can save money by eliminating many unnecessary steps. Paperwork and data entry time will be reduced, as will large phone bills resulting from transmitting damage information and trying to solve problems over the phone. The labor time spent solving problems will also decrease, because relevant data will be available immediately. In addition, people might be more willing to share information if it is easy to do so.

COST/BENEFIT ANALYSIS

Unfortunately, this research does not include a cost analysis for implementing a distribution quality control system. It was not possible to obtain information from the five firms on how much damage costs them annually, and it was nearly as impossible to determine the costs of implementation for each of the firms, due to differences in size, channel structure, etc. Consequently, comparisons could not be made. However, potential benefits that could be realized follow.

BENEFITS**Damage Reduction and Increase in Profit Potential**

Unfortunately, figures are not available to show the difference between damage occurrences before and after implementing a damage management system. There is no numerical proof that having such a system can save money. One can reason, however, that having reliable information about damage and taking steps to reduce the sources of damage, will lead to less dollars in lost profit due to damage, and may increase sales.

Less money will be spent replacing merchandise, and paying return transit costs. The benefits may vary by industry. Higher charges are usually incurred when shipping replacement product in a custom-built industry like furniture because the lead time for completing the original order has been shortened. The customer may need the product in a short period of time (after they have already waited the normal lead time for the original product), and the sale may be lost altogether. It is also possible that even more damage will occur to merchandise being returned, thereby lessening its potential to be salvaged.

Improved System Control

A formal damage management information system will allow for a continual understanding of occurrences in the distribution

environment that can contribute to damage. With improved control over the system, less time and money will be necessary to solve problems when they do arise, because valuable information will already be at hand.

Cost Reduction in Packaging Materials

The Packaging Professional will be better able to optimize packaging due to more complete information and better knowledge of what problems and situations products are exposed to in the distribution environment. This could result in less packaging materials being purchased and used, based on the knowledge that more is not always better. Overpackaging could become a thing of the past.

Improved Customer Relations and Lower Customer Service Costs

Damage loss, as well as costs associated with handling and returning damaged merchandise are explicit customer costs. Dealers and customers are a key part of a damage management system and they should be involved in developing the system that they will be held partly responsible for maintaining. By exhibiting more concern to meet their needs, they might feel more of a "connection" with the manufacturer, leading to increased sales.

Customer service costs could decrease with the existence of a damage information system. Less money and time for the

customer service representative (and those that further analyze and try to correct problems) will be spent trying to solve problems, because information will be readily available. In depth searches for details of damage occurrences will no longer be necessary in many situations.

Fewer Claims and Improved Carrier Relationships

Reliable information leading to better products and packages, coupled with better knowledge for the workers who handle the product, could lead to a significant reduction in damage, and therefore claims. Better relationships with carriers could most definitely exist with less controversy over who caused damage.

Improved Employee Performance

Each of the case representatives agreed that the simple knowledge that a formal damage management system exists could be a benefit. Workers are more careful and helpful if they are sensitive to damage issues, if they are educated to observe and classify damage, and if they feel they are essential to the company's success.

Workers' participation in the system should not be used against them, where they are disciplined if they make an error and cause damage. On the contrary, they should be encouraged to pass on information about the causes of damage that they

experience so corrective action can be taken to avoid its future occurrence. It is important to educate all employees on the workings of the system, and how it can benefit the firm as a whole. Not only should standards and procedures be made clear, but also the reasons why they exist.

PACKAGE IMPLICATIONS

In addition to protecting the product, the package plays a role in product modification, transport costs, and in the claims settlement procedure. A damage management information system could also allow for the collection and analysis of information that could help in these areas. However, the most benefits realized will be in damage reduction due to better information and therefore better packages. At last, the packaging professional can know how much and what kind.

Solving quality problems which result from insufficient packaging requires a method for predicting whether a proposed package would perform better. Package protection performance evaluation benefits a great deal from an information system which improves knowledge about damage.

Using this information, tests can be correlated to real performance through failure modes. This is known as the "Damage Reproduction" theory of package testing. Developing package test methods from damage information is a simple

matter of taking the available technology--state-of-the-art package shock, vibration, compression, and shelf-life evaluation equipment--and using it to reproduce damage. For instance, if the corners of a particular piece of furniture usually break off, there should be a test developed to judge which package best prevents corner breakage.

The Damage Reproduction theory is used, for example, by the United States Department of Agriculture who relies on the Michigan State University School of Packaging to develop performance specifications for the food it purchases. (It is the largest food distribution system in the world including Food-for-Peace, school lunches, prisons, charities, disaster relief, and price support commodities). Performance specifications are all test methods developed to reproduce the damage most likely to occur in a given product-package-distribution system, based on analysis of typical failures (Twede et al, 1990).

Since there is no direct correlation between package cost and performance, testing provides a means for comparing economical alternatives to the package which is currently used. Thus, even if there is currently no significant damage problem, a damage information system can provide the direction for testing to proceed by indicating prevalent damage modes.

IN CONCLUSION

Each firm investigated in this research would benefit by combining their informal subsystems and developing a comprehensive and formalized system to control product quality in distribution. System development would begin by establishing a team who can manage the system. That team should first evaluate all those who will be a part of the system to find out what part each will play. Next, everyone involved should be educated and trained on the logic and workings of the system. Procedures and product quality should be standardized for simplicity, as should be methods of transmitting data. The database containing damage information should have the capability to analyze data in any ways necessary to make intelligent decisions about corrective actions. Corrective actions should be addressed at the causes of the problems, not just the problems themselves. Lastly, processes should be continually monitored to assure conformance, even after corrective action has been taken.

A distribution damage management system can continually identify lucrative opportunities to improve the quality of products delivered. By setting performance standards, tracking and analyzing conformance, and then upgrading performance levels and re-evaluating standards, the logistical quality system can continue to improve.

LIST OF REFERENCES

- Anderson, June E. Case firm - personal interviews.
- Baker, Edward M. 1988. "Managing Human Performance." Juran's Quality Control Handbook. Fourth edition. New York: McGraw-Hill.
- Banks, Jerry. 1989. Principles of Quality Control. New York: John Wiley & Sons.
- Bennett, Don. Case firm - personal interviews.
- Bingham, Gordon J. 1989. "'90's Agenda Reveals Nod to Manage Effectively in a Changing World." Marketing News 23 (Aug 14): 11-12.
- Boggiano, Chris. Case firm - personal interviews.
- Bonoma, Thomas V. 1985. "Case Research in Marketing: Opportunities, Problems, and a Process." Journal of Marketing Research 22 (May): 199-208.
- Boulton, William R. 1985. "Case Study as a Research Methodology." Case Research Journal. 3-14.
- Bowersox, Donald J., Closs, David J., and Helferich, Omar K. 1986. Logistical Management. New York: Macmillan.
- Bowersox, Donald J., Daugherty, Patricia J., Droge, Cornelia L., Rogers, Dale S., Wardlow, Daniel S. 1989. Leading Edge Logistics: Competitive Positioning for the 1990's. Il: Council of Logistics Management.
- Burr, William G. Case firm - personal interviews.
- Cavinato, Joseph L. 1975. "Analysis of Loss and Damage in a Procurement Distribution System Using A Shrinkage Approach." Doctoral dissertation, Pennsylvania State University.
- Crosby, Philip B. and Esterby, Jim. 1985. "Don't Forget Distribution as Potential Problem Source." Purchasing. (January 17): 66A31.
- Crosby, Philip B. 1979. Quality is Free. New York: McGraw-Hill.

- Deming, W. Edwards. 1986. Out of the Crisis. Cambridge, MA: Massachusetts Institute of Technology.
- Deming, W. Edwards. 1982. Quality, Productivity and Competitive Position. Cambridge, MA: Massachusetts Institute of Technology.
- Feigenbaum, A. V. 1983. Total Quality Control. Third edition. New York: McGraw-Hill Book Company.
- Fisher, Suzanne M. Case firm - personal interviews.
- Geertz, Clifford A. 1973. The Interpretation of Cultures. New York: Basic Books.
- Gryna, Frank M. 1988. "Field Intelligence." Juran's Quality Control Handbook. Forth edition. New York: McGraw-Hill.
- Juran, J. M. 1988. Juran's Quality Control Handbook. Fourth edition. New York: McGraw-Hill.
- Lambert, Douglas M. 1975. "The Development of an Inventory Costing Methodology: A Study of the Costs Associated with Holding Inventory." Doctoral Dissertation, The Ohio State University. Chicago: National Council of Physical Distribution Management.
- Lansdale, David B. "The Vital Signs of Effective Packaging Management." AMA Management Briefing.
- "Leading Edge." 1990. DCW Distribution Network Newsletter. 4 (July): 1-2.
- Lowery, Thomas. Ethan Allen examples provided through personal conversations, 1991
- Maezawa, Eiichi. 1987. "Product Modification to Reduce Distribution Costs." SPHE Journal. (Spring): 21-22.
- Meredith, J.R. 1987. The Management of Quality Operations. Third edition. New York: John Wiley & Sons. 512-551.
- Miles, Matthew B. 1979. "Qualitative Data as an Attractive Nuisance." Administrative Science Quarterly. 24 (December): 590-601.
- Novak, Robert A. 1989. "Quality and Control in Logistics: A Process Model." International Journal of Physical Distribution and Materials Management 19.
- Porter, Michael. 1985. Competitive Advantage: Creating and

Sustaining Superior Performance. New York: The Free Press.

Radziewicz, Bruno. Case firm - personal interviews.

Robeson, James F., and House, Robert G., editors. 1985. The Distribution Handbook. New York: The Free Press.

Rogers, Everett M. 1983. Diffusion of Innovations. Third edition. New York: The Free Press.

Sinha, Madhav N., and Willborn, Walter O. 1985. The Management of Quality Assurance. New York: John Wiley & Sons. 472-497.

Thomas, L.F. 1965. The Control of Quality. London: Thames and Hudson.

Tribus, Myron. "Deming's Redefinition of Management." Quality First. Paper, Massachusetts Institute of Technology.

Twede, Diana. 1988. "The Process of Distribution Packaging Innovation and Its Relationship to Distribution Channel Structure." Doctoral dissertation, Michigan State University.

Twede, Diana, and Goff, James W. 1989. "Distribution Damage Measurement, Analysis and Correction."

Twede, Diana; Harte, Bruce; Goff, James W.; and Miteff, Steven P. 1990. "Breaking Bags: A Performance Specification Philosophy Based on Damage." Journal of Packaging Technology. (Nov-Dec).

Twede, Diana, and Palmer, Caris J. "Logistical Loss and Damage: Who Pays?" Institute Of Packaging Professionals Technical Journal. Forthcoming.

van Maanen, John; Dabbs, J. M., Jr.; and Faulkner, Robert R., eds. 1982. Varieties of Qualitative Research. Beverly Hills, CA: Sage Publications.

VanSchoick, Charles. Case firms - personal interviews.

Vasquez, Ray. Case firm - personal interviews.

Venti, Ted. Case firm - personal interviews.

APPENDICES

APPENDIX A

Information About Firm A

Setting Standards:

Critical defects are defined, but threshold levels are not set for judging acceptability limits. There are standards to reflect common types of damage, but not causes, or costs associated with damage.

Collecting and Analyzing Information:

- 1) **Field Problem Reports.** Used for damage communication, shortages, overages, wrongly labeled items, and other delivery and installation problems. Include time, contact, order number, etc. Reason codes are used to indicate particular problems. Reports also include information on: "where," (ordering, plant, distribution), "what," (product damaged, shortage/excess, etc.), "why" (improperly loaded, inadequate packaging, abusive handling, etc.), and types of "nonconformance" (bent, chipped, dents, etc.).

FPRs are filed by field technical representatives who are responsible to cover dealerships (broken down by region). They make sure the installation is going properly, and give their opinions on damage, for example, whether it needs to be replaced or can be field repaired.

Also filed by project managers, who are responsible for the ultimate customer. Often, damage information comes from them. They have to monitor progress on jobs, and have a check-off sheet with carton numbers (which are on every box), so they can see noted damage then. If damage is noted, they call the customer satisfaction department, who puts the information on an FPR.

FPRs can also be filed by a dealer.

FPRs cover external problems only (not problems on the production line, for example). The representative estimates that they get about 60% of damage information this way.

- 2) **Word of mouth.** Field technical representatives call packaging directly and tell them about problems. By doing this they can expedite problems, and the information is "straight from the horse's mouth." This is helpful to the packaging department, because the representative can send damaged product, pictures, and information immediately. Dealers have to go through

customer service first, because they want to know up-to-the-minute what's going on. If the dealers or customer bypass customer service, the "left hand doesn't know what the right hand is doing." (Field technical representatives have the right to contact packaging directly though.) Project managers can call packaging, but they must get approval through customer service first.

Letters from dealers are a source of damage information.

Dealer conventions offer a good opportunity to get first-hand information.

An estimated 35% of damage information is received through the above word-of-mouth methods.

- 3) Survey carriers by phone each month to get opinions on what they've seen.
- 4) Get some information from claims. If a carrier feels something is a consistent problem, (and something they feel they aren't responsible for, especially concealed damage with furniture), they'll raise the issue with the company.
- 5) EDI is not fully implemented. Damage information will be included. It is tied to order information, but only customer satisfaction has access to it, and quality uses information obtained from them.

Corrective Action:

Corrective action reports (CAR). Controlled by corporate quality assurance, they are a tool for issue correction. They identify issues, and a committee appoints the necessary people and action for follow up (packaging, fix damage). Standard operating procedures exist for taking corrective actions. CARs can be used for processes and people; the problem doesn't have to be damage related. Unfortunately, not many are filed from field technical representatives since it is extra paper work. This program is based on an earlier program that didn't have "corrective" in the title or in practice. That program wasn't effective because there was no corrective action and nothing was being done. People were filling the forms out for nothing.

Corrective action reports are more general than FPRs, covering internal and external problems. Packaging sees them only if they pertain to them (including damage). The company gets the remainder of damage information through this program, which is relatively new (not even a year old).

Discussion:

"Can't say that we hear about 100% of the damage, and not until it becomes a real problem."

"Dealers have warehouses and can make a quick field replacement, so the company does not hear about those problems since they wouldn't need to order a replacement and they don't always return the damaged part".

"A lot of the damage is minor stuff (scratch, blemish) and union installers can resolve a lot of the cosmetic blemishes on the spot."

"Might miss some true reasons for damage, because the project manager hires the installers, who also do the unloading, and wants to maintain a good working relationship with them. Therefore, the project manager might not pass on the fact that a worker actually dropped a box, or ran into it with the fork truck, etc."

"Sometimes the project manager isn't completely educated on specific problems with fragile products, or product that should be handled in a certain way, so he/she cannot pass that information on to the installers."

Not everyone has loading docks. The product could experience a "good 4 1/2 foot drop off the back of the truck" if no one is there to grab it. "Undoubtedly, there is a lot of damage that takes place during the handling and unloading, and even installing. Very often it has nothing to do with packaging, but handling. Furniture is hard, it's bulky, heavy, and not easy to handle quickly, especially when it gets more fancy. Can't over-pack the daylights out of it, because the cost gets too high."

"Packaging needs a foot in the door with product development to give input on the structural integrity of things and how they can survive the distribution environment. Input is usually after-the-fact. Packaging gets brought in after designs are frozen, and has a certain amount of the product cost to work with for the package. It is necessary to develop good relations with product development so they can begin to understand packaging and handling needs, because it helps them out in the long run."

Broad goals:

Corporate goal in 1990 to reduce FPR's by 50% overall. Packaging did it by 60%. Distribution as a whole reduced them in excess of 50%. The same goal is in effect in 1991. Goals put more emphasis on reports, where before they might have been put on the back burner.

Benefits:

Damage has been reduced through value analysis in pkg. "There is definitely a benefit to measuring damage."

"FPR's add a psychological benefit that makes everyone put more care into their job. It's a management tool that you can use to enforce what's got to be done. It's follow up to track progress. All people on the loading docks are fully aware of how many FPR's are processed against their department. Management can track back to who actually loaded (the lowest possible level), and get their involvement in a positive way by asking how things could be different so the problem doesn't happen again."

APPENDIX B**Information About Firm B****Setting standards:**

Critical defects are not defined, and threshold levels are not set for judging acceptability limits. There are no standards to reflect controllable variables: common types and causes of damage, as well as cost associated with damage.

Collecting and Analyzing Information:

- 1) Replacement orders (also called claims) are the major way they get information. They covers "a good portion of damage information." Packaging gets these replacement orders from customer service when someone feels it is something packaging could help with.

-or-

If packaging thinks there is a problem with something, they tell customer service representatives to watch out for replacement orders with that particular problem behind it.

- 2) Word of mouth information from phone calls, individual dealers.

"Get more information than you'd think from carriers. The customer makes a claim with the carrier. If there's a problem, the carrier comes back to us, so you find out damage information that way."

- 3) Postcards are attached to every order. The customer can rate areas (on-time, etc.) including damage. The customer order number is on the card, so problems can be traced back to routes, carriers, etc. Postcards are returned to shipping, who passes them on to packaging if there are any poor ratings in damage, packaging, etc., or if there are any comments that could be helpful. Once postcards are received (only about 10 at the most per month), the packaging people just keep it in their minds and look for recurring problems. The process is customer driven - information is relayed only if they want to respond.

Corrective action:

"We just do whatever has to be done. It doesn't matter if it's not a packaging change."

Verbal follow up contact is usually made to find out what the damage was really like.

Survey customers.

Training--Many workers don't understand principles of unloading. They've found workers inverting loads from how they were in the trailer. A big concern is that the customer might not have equipment, loading dock, or trained workers. "We need information on what the customer has available to them...it should be included in order information."

Discussion:

Estimate damage at less than 2% of sales ("which is good"). Firm will soon be changing shipping terms to FOB destination so firm B can handle claims instead of customers. This will lead to better information.

The company doesn't see concealed damage claims sometimes, because if installers can fix it or get it from a dealer's warehouse, there is no replacement order.

Negative aspect of surveys and postcards: There might be one damaged product out of thousands, and the customer will circle "poor packaging". So you don't have quality information all the time. "You don't know who's telling you what, and you have no idea of the magnitude of the problem. There is a lot of subjectivity involved."

Packaging could go to shipping and get a printout of every cracked drawer front from here to California in the last six months, but it would take forever because they can sort by destination but then they have to read each comment section. Plus, it often only says that damage existed in the shipment, but not what products or specific type of damage occurred, or how it happened.

Benefits:

There has been a reduction in damage since they started monitoring just because packaging took action.

There is a psychological advantage from handlers knowing their work is being monitored.

APPENDIX C

Information About Firm C

Setting standards:

Critical defects are not defined, and threshold levels are not set for judging acceptability limits. There are no standards to reflect controllable variables: common types and causes of damage, as well as cost associated with damage.

Collecting and Analysing Information:

1) Replacement orders.

Tracking the number of complaints (or requests for replacement parts), can give a good idea of what issues continually come up.

2) Surveys from dealers.

3) Field audits at major installations.

Any order that is a certain amount or more gets audited by questionnaire, and over another amount has a field audit. Audit surveys are collected by the quality department, and are used in quarterly reviews. An estimated 20% of all orders are this amount or more, but that 20% is 80% of the product volume. It was estimated that they get about a 45% response rate from the questionnaires. 80% of orders are 20K or less, consisting usually of replacement or addition product. But, the big orders usually go TL, while the others go LTL where most of the damage happens. So, audits usually come back with minimal damage information.

3) Business partner in Japan distributes some product. They receive and warehouse the product, and handle the Japanese logistics from there. Their standards are very high, and they "won't take anything that's blemished in any way." For this reason, product is inspected before it's containerized. Very detailed weekly reports are the result. Statistically significant information is received, and it is considered to be very indicative of what's going on with damage throughout the entire distribution channel. "It gives you a good sense of whether the package is doing its job or not." However, by the time it's inspected before being containerized, it's already been shipped 3000 miles. The reports often claim that "damage probably occurred before packaging," so it could be from some point in the manufacturing process. Their standards can be over-demanding.

- 4) "The company still depends a fair amount on informal communication", and it's the best kind of information sometimes, but you don't get it until it's already a big problem."
- 5) Get monthly total damage reports (in dollars) from carriers, but no specific detailed information.
- 6) EDI. Real time on-line system via satellite. Major dealers get a dish. They can check on the status of orders, place orders, change orders, etc. The system is evolving so dealers can include information about damage and replacement orders.
- 7) Verbal communication from people that actually operate the dealership (versus the owners). "Get lots of first-hand problems and information that way. We need to continue to get out there on a regular basis because that's where you get a lot of information."

Corrective Action:

Quarterly quality reviews (from data gathered), highlight any particular trends from a standpoint of quality. Then, the product maintenance manager and packaging manager go through and review the data with the quality department using trends on various product types. They focus on the five biggest quality problems each quarter and that's where they put the major resources. Then they work to get it off the list, but continue monitoring it.

Packaging teams are sent out to investigate specific problems.

The Packaging Manager is currently putting together a training video for a packaging process. "Over time, workers get away from the way it's supposed to be done". So, they're making a video to remind workers why the standards were set that way in the first place. The problem stems from conflicting goals, because the workers have to keep pace with production schedules. Packaging then has to go back through management to suggest a change in the work standards. It is difficult though, because management doesn't want to have to put an extra worker in to keep up with the production pace.

Goal to reduce corrugated use, primarily by increasing blanket wrap.

Discussion:

The Packaging department is working very closely with distribution to increase use of TL shipments.

"Feedback of course is important"

Classes of dealers: Some are committed to their product, and other, non-competing lines are approved. They are called office pavilions, and there are about 35 of them. The company does "a good deal of our business through them." The company handles their payroll, logistics planning, inventory, and other overhead issues.

The next level of dealers are a little more independent. They won't agree to all of the stipulations required to be a top level dealer. They could do as much of half of their volume through the company. They maintain a little more autonomy.

The person placing the reorder often isn't the person who saw the damage. They were just told to order a new one. Information is second- or third-hand. The how of the damage is hard to get. "Anytime you can get communication closer to your agents, the opportunity to get the how improves"

There is a lost opportunity when inventory is taken monthly and quarterly at a warehouse because damaged product is scrapped out, and it doesn't say why (there are no detailed reports).

Quality teams deal with specific problems (for example, products, on-time delivery, etc.). The team is multi-disciplined. "For example, there's a team working on distribution techniques, trying to get away from using LTL. I may be being unduly harsh, but I think furniture and LTL are incompatible, and I'm pushing the organization to get away from it.

APPENDIX D**Information About Firm D****Setting standards:**

Critical defects are not defined, and threshold levels are not set for judging acceptability limits. There are no standards to reflect controllable variables: common types and causes of damage, as well as cost associated with damage.

Collecting and Analyzing Information:

- 1) National accounts - the company files claims for these accounts, and can gather damage information from them.
- 2) Special claim investigations.
- 3) Carrier monthly reports - They show the claim amount, the type of claim, the product (which is not always listed), the status of claim, and whether it is concealed or noted damage, but not what kind of damage. Carrier monthly reports are analyzed more often to find out what carriers are getting more damaged product (so as to correct problems with the carrier) than they are analyzed to find out what products experience more damage (unless it's noted that a particular product is experiencing a lot). Packaging is a minor problem. The company goes beyond classifications. They rarely have carriers denying claims due to improper packaging.
- 4) Mostly word-of-mouth when there's a repetitive problem. Then people in other departments are called in, and they do quality assurance and packaging checks. "It all centers around the information that we get back from our dealers." There is also informal communication from people from various departments when there is a problem.
- 5) Expediter's monthly report. Covers problems that are noticed before product gets out the door. These reports are more detailed than information about finished goods in the channel. Paperwork is generated to send product back for rework in the area where there was a problem. It helps to assure the product will not go out the door damaged. Damage has gone down since they've been measuring, maybe because workers know the report is being generated. "Before it's packaged, it should not be damaged. If it is, they should be sending it back. Unfortunately, some things do get passed on because they figure someone on down the line will take care of it."

- 6) Surveys. Questionnaires are sent out on all aspects of distribution (on-time, shipment complete, friendliness of drivers, etc.) The firm doesn't get a lot of feedback, and they aren't detailed about damage.
- 7) Audit teams sent out in the field will find out a lot of information, but this isn't done often.

Corrective action:

Educating dealers on how to unload is very important in being preventive, because it's really a problem, especially since a lot of the workers at smaller warehouses are summer help, part time, etc. like a grocery stock boy. "I predict that most of these claims are an issue of unloading. It's a gut feeling, but we often find problems there." But it's a lot of money to make videos, etc.

Discussion:

"We don't really know damage in dollars. Could tally (very time consuming) national account claims from monthly reports, and get outstanding claims, but there is nothing in relation to percent of sales, etc. National accounts are a very small portion of total business though."

"As a corporation we're very serious about damages." "We're sure that we're missing some of the claims on that data, because of who's filing the claim."

"We have less damage because the majority of what we haul is blanket-wrapped." This ties in with using considerably more TL shipments.

The firm has the capability on computer to sort by product and find out how many times it appeared in claims (but only if the claim specified the product). All information is mixed in with the company mainframe, and it's "certainly not the total picture, because it's just the claims we get involved in." These claims are called dealer assistant claims, and arise when the carrier doesn't pay. The firm will work with these dealers, and investigate the problem to get something out of carrier.

Year-end reports have the total of claims filed, but the number includes loss, damage, delay, theft. They are not separated.

The worst claims are for file cabinets (because of weight, awkward size). If there is a particular series or line of cabinets getting damage, they go back to the source and try to figure out where/why it happens.

"When you look at the product as a whole that we manufacture and ship out of here, in number of pieces, we don't really have a serious damage problem. If you compare the number of pieces damaged with the number of pieces we ship out of here in a year, its really not that bad. But when damage does happen, we've got a customer waiting for it, and now they have to wait some more, and sometimes it gets damaged a second time."

"Corporations are reluctant to publicize a negative issue.

There is less damage with product shipped uncrated (blanket-wrapped), which is 63% of TLs, or volume shipments. However, this only represents about 40% of the product. Concealed damage goes away. Can inspect and reject products right away. This helps with product coming off the line too, since it can be rejected before shipment.

"There are a lot of products that we are forced to package (glass, lights, wood table tops, etc.). We would like to ship everything we can uncrated. It depends on the destination, because some dealers aren't set up to store uncrated product. More product can go uncrated if it's going direct to the job site."

"Preventive maintenance is tough to deal with in a corporation because upper management doesn't want to extend any money. You have to justify it, but where's your proof? There's no justification in numbers."

Benefits: Less delays and callbacks.
Psychologically, workers might handle product better.

APPENDIX E**Information About Firm E****Setting Standards:**

Critical defects are not defined, and threshold levels are not set for judging acceptability limits. There are no standards to reflect controllable variables: common types and causes of damage, as well as cost associated with damage. The system is currently under revision to include such variables.

Collecting and Analyzing Information:

Customer service is the recipient of the data, and quality assurance collects it and manages the database. They then publish quarterly reports with trends.

- 1) Customer service replacement orders. Normally, if there is packaging related damage, the dealers (who are installing) will get back to customer service. Ideally the company will get a replacement order every time there is damage because the customer needs new product. Customer service notes why there is a replacement order, so you know about damage. "They give a good indication of the overall damage problem." It was hard to implement the system, because sales people, customers, etc. don't want to do any more paperwork than absolutely necessary.
- 2) Pre- and post-pack audits.
- 3) Internal document called Discrepant Material Report (DMR) can also give damage information from stock situations. Would not get much damage-due-to-packaging information, mostly handling problems. Even so, the document indicates there was concealed damage, but not what kind or how it happened.
- 4) Electronic mail - all major dealers, sales offices, and showrooms are tied in. Good method of obtaining damage information because it's instantaneous.

Discussion:

There "really hasn't been a big damage problem", estimated at less than 1% of sales.

"If it's somebody else's fault (like someone driving a fork truck through a file), we're not going to hear about it." But if it's noticed right when they break the seal on the truck, or remove the blanket wrap, they'll file an FPR right away.

"If there's stock at the branch, they can wheel and deal through the branch/warehouse, and you never find out about some damage." However, now the company requests any questionable product back so they know what's happening.

Corrective actions:

Quality teams focus in on specific problems.

Track non-conformance costs through FPR system. Problems get traced back using problem codes to a work center or department. It then affects their budget as a cost allocated against that work center. They are evaluated on a monthly basis.

They used to have a quality document that was sent with each product (quality service card). It was discontinued because they were going to update the way they collected data because the information was too subjective.

"Quality is in the eyes of the consumer."

MICHIGAN STATE UNIV. LIBRARIES



31293009008859