To the Graduate Council:

I am submitting herewith a dissertation written by Stephen M. Rutner entitled "Quantification of the Value of Logistics: Creating an Understanding of the Value Process." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

C. John Langley, Jr., Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor
and Dean of The Graduate School

Quantification of the Value of Logistics

Creating an Understanding of the Value Process

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Stephen M. Rutner

December 1995

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DEDICATION

This dissertation is dedicated to my wife

Paige S. Rutner

who supported me on all those "bad" days along the way.

ACKNOWLEDGMENTS

I would like to thank my major professor, Dr. C. John Langley, Jr., for all of his guidance and support. I would also like to thank the other members of the committee. Dr. Mundy, Dr. Mentzer and Dr. Chatterjee worked with me on various projects. The four individuals acted as mentors and friends. I appreciate all of their help in beginning my academic career. Each provided me opportunities to improve my skills as well as my vita. For those learning opportunities, I am very grateful.

I would also like to thank my family. My wife supported me in spite of all the days it took me away from home. My gift to her is that I will now be home more than two days a week. My family deserves my thanks for providing me the educational background to succeed. They sacrificed to ensure that I had the opportunity to receive the best education possible.

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ABSTRACT

There is little doubt that logistics adds value to the total business process. Various authors have identified the different types of value from the traditional place and time utility to the more recent concepts of customer service. This understanding leads to the question of quantifying that value.

The research was conducted in three phases. The first consisted of a literature review of the current writings. Next, a research team conducted a series of case studies and a mail survey. The third phase consisted of a follow-up survey. There was a detailed analysis after each case study and survey.

The dissertation identified the most common measurement techniques. The most commonly used methods were the operational performance measures. The less popular techniques were the financial and cost type measures. Also, the dissertation determined the relationship between specific measures. The financial measures of logistics value were highly correlated.

Another key point was the finding of the definition of value. While companies attempted to measure logistics value, less than half had a clear definition of what they were trying to quantify. Fortunately, two-thirds of the individual respondents had some personal concept of the definition of value.

Part of the definition of the value of logistics was value-added. The terms, value and value-added, were used interchangeably in the case studies. However, the survey identified significant differences in the application of value-added services. The companies

that provided value-added services appeared more advanced in the quantification process. They had a better definition of value and more success in measuring customer service quality in dollar terms. Finally, the companies that provided value-added services were more likely to view logistics as a competitive advantage.

In addition to identifying definitions and measurement techniques, the dissertation determined the areas that logistics organization measured value, costs and operational performance. There were fifteen areas examined in the dissertation and a previous study by A. T. Kearney, Inc. There was tremendous growth in the involvement of logistics in the company's overall operations.

The final portion of the research was the presentation of a number of models from the findings. These included definitions, best practices and an implementation process.

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LIST OF ABBREVIATIONS

Activity Based Costing	ABC
Council of Logistics Management	CLM
Efficient Consumer Response	ECR
Just-In-Time	JIT
Means-End Value Hierarchy Model	MEVHM
Quick Response	QR
Return on Assets	ROA
Return on Investment	ROI
Total Design Methods	TDM
Total Quality Management	TQM

Chapter I - Introductory Overview

Introduction

There is little argument that logistics is necessary. However, the question arises as to whether or not logistics is a value adding operation or merely a cost. A recent article by John Tracy very eloquently argued that logistics managers and hence logistics itself does add value. The distinction of "essential" or "nonessential" was different from value. The idea of place and time becomes essential and must occur just to compete in a market. Therefore, it is essential and does add value. As might be expected, he states that accountants define most logistics activities as "non-value-adding."[1] This raises the question of what is the value of logistics and how do we measure it?

Many companies have already decided that logistics adds value. A recent study conducted by Novack, Rinehart, and Langley found that many executives believe logistics operations and services add value to their product.[2] Some of these companies included General Nutrition, Corning and Welch's. Other individuals and companies, such as Toyota and Texas Instruments, argue that logistics does not add value. They view logistics as an accounting cost and not an area that adds value. Again, the major question arises as to the value that logistics adds.[3] There is clearly a difference of opinion over this topic.

Even Michael Porter's Value Chain Model shows that logistics is a key component that adds or creates value.[4] The in-bound and out-bound logistics areas are two of the

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[1] Tracy, John J., Jr., "Do Logistics Managers Add Value?," Inbound Logistics, Vol. 13, No. 6 (June 1993), pp. 16.

[2] Novack, Robert A., Rinehart, Lloyd M. and Langley, C. John, "An Internal Assessment of Logistics Value," Journal of Business Logistics, Vol. 15, No. 1 (1994), pp. 113 - 152.

[3] Graff, Herb, "Business Process and Cycle Time Management," Texas Instruments Incorporated Workshop, 1993.

[4] Porter, Michael, Competitive Advantage: Creating and Sustaining Superior Performance, (New York, NY, The Free Press, 1985).

primary areas that create value (Figure I - 1). His work provides further support that logistics does add value, but does not provide specifics such as the actual amount or how to quantify that value.

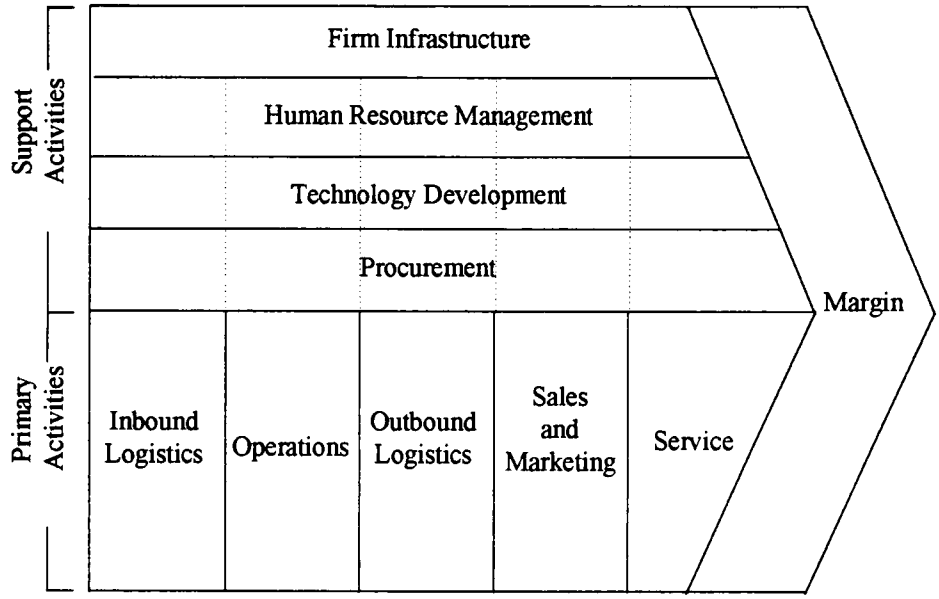


Figure I - I
The Value Chain[5]

The next question is if we assume that logistics adds value, is it important to firms or customers? Is logistics' value relevant? Should logistics managers be able to measure value? The answer is a resounding yes. Management must make allocation decisions based on the value provided to the customer and its return. Battles for limited budget dollars highlight the importance of logistics value. Every company has limited resources

[5] Ibid.

and departments often disagree over the budget. Does the company need new tractor trailers, bar code readers, logistics information systems or does it need more advertising, new production machinery, etc.?

A useful way to approach the importance of this question is to compare logistics with some of the other components of the total product. The concept of the marketing mix, or the Four Ps, is useful to compare the value added versus the necessary cost.[6] The three Ps of product, price and promotion have achieved some success in quantifying each P's value to the customers.

The increased value of improved product at a constant price can be measured by the increased sales of this product. Also, the level of advertising and promotion is normally measured in the change in the level of sales. These three Ps have achieved greater success at measuring their value creation.[7]

However, many argue that the last P of place (customer service or logistics) does not add any value.[8] What makes it so special or significantly different as to not add value to the customer? In each of the other parts of the marketing mix, value has been identified and used by companies to attempt to improve their business. Logistics has been used as a tool to gain competitive advantage. These facts infer that place should add value also.

This inconsistency turns the focus to customer service. Another question the Novack, Rinehart and Langley survey asked "if your company views logistics as a value, how do you quantify that value?" The majority of executives answered that they did not know. Much, if not most, of the measurement of logistics was left to qualitative decisions

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[6] McCarthy, E. Jerome, Basic Marketing: A Managerial Approach, 9th Edition (Homewood, IL: Richard D. Irwin, 1981).
[7] Lamb, Charles, Hair, Joseph F. Jr., and McDaniel, Carl, Principles of Marketing (Cincinnati, OH: South-Western Publishing Company, 1992); pp. 212-242.
[8] Tracy, op. cit., pp. 16.

based on the managers' perceptions.[9] Clearly, even the supporters of logistics as a value find it difficult to support their position without quantitative proof, instead of the traditional qualitative perceptions of the managers.

These perceptions can be a problem, as identified by Parasuraman, Zeithaml and Berry.[10] They identified the gap between perceived and expected customer service. The gaps between managers and customers are further adding to an already cloudy system of measuring the effectiveness of logistics. Now there is not only a difference between perceptions of service, but also the perception of whether logistics is adding value. Currently, there does not appear to be an accurate quantification system available to manage efficiently the logistics services and to close these perceived gaps.

There have been some attempts to quantify the value of logistics services. The literature review will present the findings of these studies. However, none has presented an effective method of quantification. The Novack, Rinehart and Langley assessment of logistics value provides a useful model as a framework for this study (See Figure I - 2).[11]

This model provides an excellent overall explanation and an origination point for quantifying logistics' value. In the model, the value of logistics service plays a key role in the realization of the customers' satisfaction. The internal and external customers receive the benefits of a successful logistics system. The importance of that value must be identified in some measurable form. This study will build upon that model by developing a methodology for quantifying the value that those logistics services add to the entire customer satisfaction process.

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[9] Novack, op. cit., pp. 114 - 118.

[10] Parasuraman, A.; Zeithaml, Valerie A. and Berry, Leonard L., "A Conceptual Model of Service Quality and Its Implications for Future Research," Journal of Marketing, Vol. 49, Issue 4 (1985), pp. 41-50.

[11] Novack, op. cit., pp. 117.

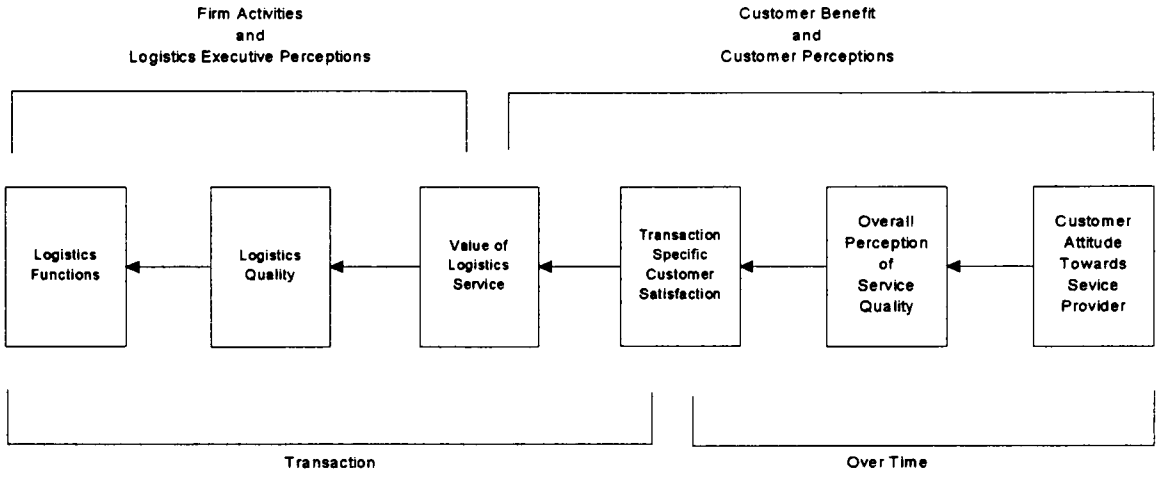


Figure I - 2
Relationship Between Logistics Executive Perceptions of Service Quality and Customer Attitude Towards the Service Provider[12]

The actual value of logistics section of the model will be expanded upon and examined in more detail. The model's framework identifies the lack of understanding of the actual quantification procedure and highlights the need for an effective quantification process. It helps to visualize the framework to identify limitations of measuring logistics value.

Statement of the Problem

The purpose of this study is to investigate the concept of the value of logistics to business, to describe / define that value, and finally to identify the quantification process of the value. The Novack, Rinehart and Langley model will be used to guide the research and help frame the context of the services examined. The best practices of various

[12] Ibid.

companies will be placed within the framework of the model to help quantify the value of the logistical services provided.

There are two major research questions that will drive the study:

1. If we assume that logistics adds value, how is that value determined and defined?
2. Once value has been determined or defined, how do we quantify that value?

Although the Novack, Rinehart and Langley study showed that managers perceived logistics adds value, this research will attempt to provide further validation.[13] One shortcoming of the Novack, Rinehart and Langley study was it did not identify if customers, not managers, believed that logistics adds value. The first research question will also help to focus the respondents' responses on the quantification portion of the material being examined. The question will help define value and will prepare a basis for building the foundation for the second question.

The second question will be the heart of this work. The eventual goal is to identify a useful method for companies to quantify and to measure their value of logistics services. Although this is an aggressive undertaking, even a few, small steps toward the completion of this goal would be a valuable addition to the current body of knowledge. It is unlikely that one model can be developed that is universal. However, a model may provide a starting point for individual companies.

The two major research questions will be further subdivided into the following four categories for examination: definition, quantification, best practice, and application. The different categories will identify specific areas and questions about the two major

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[13] Novack, op. cit., pp. 127 - 146.

research questions. These categories provide a logical framework to examine the problem.

The definition category helps to answer the first major question. "Value and value-added" must be properly defined to lay the foundation for the remainder of the research. An understanding of value is needed to ensure the following parts of the study are examining similar information. Some of the key questions include:

1. How do logistics managers define value? Who (internal and / or external to the firm) sets the definition of value?
2. Is there a difference between value and value-added? Are there common definitions, themes and practices between successful companies?
3. Do companies that differentiate between logistics' value and cost perform differently than organizations that do not?

This first part of the problem will be difficult due to the lack of a standardized definition in industry and academia. Logistics services must be properly defined as a basis for this study. Another goal of this study is to propose a definition of logistics value that can be standardized through the business and academic community.

The next three categories deal with the second major research question of measurement. The quantification of the previously defined value presents another problem. How does a company accurately reflect the value in time and place utility? Is it as simple as an all or nothing measure? A system or model would be very useful to logistics divisions and firms to clarify the basic value and more advanced value-added services. A number of important questions are apparent at the beginning of the research.

1. What is the correct measure of logistics value?
2. Is it appropriate to attempt to quantify value with customer service or other substitutes?

3. How can it be possible to accurately measure customers' perceptions of logistics services which are often "invisible" to the user?
4. Is return on investment the correct measure?
5. Is there a combination of smaller measures that could be combined to provide a better overall measure?

These questions present a starting point for the research. The nature of this exploratory research will demand that the questions created to examine the companies may evolve throughout the process. Enough research will have to be conducted to ensure that a large enough sample is achieved from the final set of questions. Also, some of the qualitative types of measures, managers' and customers' perceptions and feelings of logistics service, will have to be examined and quantified. The rewards of successful quantification will enhance logisticians' business practices and positions within their firms. As stated previously, successful quantification will allow logistics managers to compete more efficiently for limited budget dollars.

Part of the research process is the examination of the best practices of current firms. This benchmarking of good firms will help to identify some of the quantitative measures identified in the previous section. The value of this step is that benchmarking may also provide methods and results that can be helpful to other firms. The specific areas that will be addressed during the benchmarking include the following.

1. What are the best practices of determining value in use today?
2. Which measures and definitions of value are being used by companies that view logistics as a value compared to companies that identify it as a cost only?
3. Do companies that measure the value of logistics have greater financial success (profitability, market share, ROI, ROA, market leadership) than companies that do not quantify?

4. Are there specific measures of value that are indicators of long term success (survival and growth) for that company or division?

The final section deals specifically with the applicability of all the information. The concern of the initial case study approach may be the lack of external validity due to the limited number of cases that may be performed. A major goal is to present information and a model that can be applied by many companies. Specific questions will identify the areas, techniques, and measures that companies can use to quantify their processes.

1. What factors can be determined from benchmarking the best companies?
2. Are there any methods that can be combined to increase the external validity?
3. Is there a best overall combination that is useful to logistics professionals?
4. Do different industries have unique measures that can not be generalized?

These four areas (definition, quantification, best practice, application) provide the framework. Each should contribute to the research a better understanding of the value determination process.

Contributions of the Research

The goal of this research is not only to add to the body of knowledge, but also to provide logisticians with useful methods for the quantification of logistics' value. This study will provide answers to some of the critical questions that logistics managers face when dealing with other functions within their companies. This study will help to answer the following questions:

- Can this study identify the value that logistics provides?
- What tools do logistics managers need to employ to determine value?
- How have these methods helped other companies?

- What measurement types could benefit the manager's company?

The answers to these questions are useful for a number of reasons. The first is continuing to validate logistics as an important business function. If this study is successful, it will support previous studies stating that logistics adds value.

The second major benefit results from the quantification. The development of a system for measuring the value will provide a useful tool for managers. Logisticians would be able to more efficiently manage their people and assets by stressing the functions that provide value. The quantification could further the use of other tools and techniques employed in the logistics field: statistics, total quality control, process control management, activity based costing, etc.

Not only are there benefits for the practitioner, this study will contribute to the academic body of knowledge in a number of areas. The development of a methodological model will increase the understanding of under what conditions firms adopt various quantification methods. Furthermore, this study will clarify the outcomes of adopting a quantification process. These outcomes could include financial benefit, market share or operating efficiencies. A goal of this study is to provide an understanding of how the logistics' value quantification process effects the entire business or company. A better understanding of that relationship would add to the current body of logistics knowledge.

Key Assumptions and Limitations

The first major assumption is that logistics does add value. The previous studies and editorials have shown that managers believe there is value in logistics.[14] [15] [16] [17] This study accepts that view and builds upon that foundation to quantify the value added.

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[14] Ibid.

The second major assumption is that businesses have developed or are developing methods to measure the value added by their logistics functions. Even if these methods are rudimentary, they will provide a basis for the creation of a working model. This assumption is critical for the comparison or benchmarking of the best practices of the logistics industry.

A major limitation is the amount of external validity of the study. Much of the early research will be case studies based on in-depth interviews. Since it will be possible to accomplish only a limited number of interviews, the level of generalization may be limited. However, the largest possible number of interviews will be conducted and the follow on surveys will be administered in an attempt to minimize this problem.

Responsibilities of Various Researchers

The first part of the research is a team effort: Michigan State, Pennsylvania State and University of Tennessee. The Council of Logistics Management (CLM) funded this initial phase. This researcher is part of that team. However, all propositions, all hypotheses, literature review, second survey and research questions were developed independently by this author. The areas for which the team was mostly responsible include the case study guides, case study interviews and first survey design. The methodology section will further delineate the responsibilities of the team and this author.

---

[15] Stock, James R. and Lambert, Douglas M., Strategic Logistics Management, 2nd Edition (Homewood, IL; Irwin Publishing, 1987); pp. 172 - 173.

[16] Coyle, John J., Bardi, Edward J. and Langley, C. John Jr., The Management of Business Logistics, Fifth Edition (St. Paul, MN; West Publishing Company, 1992); pp. 38 - 39.

[17] Shapiro, Roy. D and Heskett, Logistics Strategy: Cases and Concepts (St. Paul, MN; West Publishing, 1985); pp. 6.

Outline of the Study

This dissertation will consist of seven chapters: Introduction, Literature Review, Research Methodology, Case Study Findings, Survey Findings, Models and Conclusions. The Literature Review will be based on the areas of value, customer service and measurement / quantification. The Research Methodology chapter will restate the research objectives and questions, describe the methodology including the study participants and select study instruments. The two findings will describe data analysis of the data collected during the course of the study. The Model Chapter will present the various models developed from the findings. Finally, the Conclusions chapter will state findings, present a working model and identify directions for future research.

Chapter II - Literature Review

Introduction

The purpose of this section is to integrate three separate areas of relevant work: value, gap analysis and measurement. This literature review builds a solid foundation to continue the research. Each of the different areas adds to the background necessary for the current research to have relevance without being redundant.

This chapter will first cover value, then the Texas A&M gaps model and finally measurement. The next step of the review will be to integrate these related but different topics into an area demanding further study. Although any one of the three streams of research could support multiple dissertations with its breadth, it is the combination of the different areas that makes this work unique. The remainder of this chapter will provide the background of the areas and point out the different features of the combination of the three topics.

Value

Value has always presented a problem to the so called soft or business sciences. It is often very difficult to determine what exactly value represents. This has always been further complicated by the individuals' personal decision of what constitutes value. The best starting point of what is value is the simplest definitions.

Different dictionaries state very similar, however slightly different, definitions. A few are presented to introduce some contrast. It is interesting that the American Heritage Dictionary has ten different meanings alone for value. The first two represent the closest meanings to "value" with regard to logistics.

> Value is an amount considered to be a suitable equivalent for something else: a fair price or return for goods or services.
>
> Value is worth in usefulness or importance to the possessor; utility or merit.[18]
>
> Value is worth, desirability, utility, qualities on which these depend.
>
> Value is a numerical measure of quantity.[19]
>
> Value is that quality of a thing according to which it is thought of as being more or less desirable, useful, estimable, important, etc.
>
> Value is a fair or proper equivalent in money, commodities, etc. for something sold or exchanged; a fair price.[20]

Each of the dictionaries provided multiple definitions of value. Furthermore, there are numerous subtle variations between each of the multiple meanings. The differences only add confusion to an all ready cloudy picture. The term value has a different meaning to almost every individual, company or organization. These differences are compounded by the fact that value is also used in mathematics, ethics, music, physics and chemistry in addition to business.[21]

However, there are common threads through most of the business like definitions. The first is a constant reference to exchange or monetary units. The implication is that the value of something is measurable by the amount of another item that a person is willing to exchange. There are a number of key characteristics that describe value such as equivalent, price, exchange, amount, and return.

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[18] American Heritage Dictionary, Second College Edition (Boston, MA; Houghton Mifflin Company, 1982); pp. 1336.
[19] Concise Oxford Dictionary, Sixth Edition (Oxford, England; Clarendon Press, 1976); pp. 1285.
[20] Webster's New Universal Unabridged Dictionary, Deluxe Second Edition (New York, NY; Simon and Schuster, 1983); pp. 2018.
[21] Concise Oxford Dictionary, op. cit.

The second area of agreement is the non corporal nature or idea of value. Value may exist, but we are unable to physically hold it. The definitions describe it as worth, usefulness, quality, desirability, importance to the possessor. Since value is bodiless, it creates the variations in meaning that continue to present problems in quantifying what is value.

However, the problem with the definition of value is not limited to the general public. The field of business has the same situation of conflict. Although one would believe that the choices would be limited to more financial and satisfaction type descriptions, this is not the case. There are just as many different definitions.

The variation of the meaning is just as broad in business as in the rest of the world. The spectrum of meanings is covered from the ethical use to purely economic. Furthermore, many of today's textbooks fail to include any definition of value. Some general examples from business literature and textbooks illustrate the differences and failure to standardize any formal meaning for "value."

> Value is an enduring belief that a specific mode of conduct is personally or socially preferable to an alternative mode of conduct.[22]
>
> Value pricing provides less expensive version of brand-name product (implying that value is cost savings for similar product).[23]
>
> Value is assessed in terms of the beneficial effects from using the service, by those who incur its cost.[24]

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[22] Lamb, Charles W. Jr., Hair, Joseph F. Jr., and McDaniel, Carl, Principles of Marketing (Cincinnati, OH; South-Western Publishing Co., 1992); pp. 91, g16.

[23] Assael, Henry, Marketing Principles & Strategy, 2nd Edition (Fort Worth, TX; Dryden Press, 1993); pp. 127.

[24] Foggin, James H., "Closing the Gaps in Services Marketing: Designing to Satisfy Customer Expectations," appearing as Chapter 20 in Competing Globally through Customer Value (New York, NY, Quorum Books ,Michael J. Stahl and Gregory M. Bounds, 1991); pp. 512.

> Value is created by meeting customer requirements and by exceeding customer expectations (often by providing better value for the price).[25]

These various definitions merely hint at the differences in both the business and common usage of the meaning of value. There are numerous other of examples. However, it would be unproductive to list all the various meanings. The key point is there is not a simple definition that can be used.

Logistics is almost as guilty as the common public and rest of the business world when attempting to define the meaning of value. However, the field has come to some basic agreement in one area. The concept of value is agreed upon when utility is included.

Most logistics textbooks include some description of how value is created by time and place utility. The basic definition is that a part of a product's value is the customer's ability to purchase it at the right place at the right time.[26] [27] By this reasoning the layperson's description of logistics highlights the value concept. Often called the "Seven Rs," it defines logistics as ensuring the availability of the right product, in the right quantity and the right condition, at the right place, at the right time, for the right customer, at the right cost.[28] This definition implies that logistics adds value to the product. The process of providing product at the right place and time fits the common and traditional logistics definition of value.

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[25] Council of Logistics Management, Improving Quality and Productivity in the Logistics Process, Achieving Customer Satisfaction Breakthroughs (Chicago, IL; Council of Logistics Management, 1991); pp. 14-15.

[26] Stock, James R. and Lambert, Douglas M., Strategic Logistics Management, 2nd Edition (Homewood, IL; Irwin Publishing, 1987); pp. 172 - 173.

[27] Coyle, John J., Bardi, Edward J. and Langley, C. John Jr., The Management of Business Logistics, Fifth Edition (St. Paul, MN; West Publishing Company, 1992); pp. 38 - 39.

[28] Shapiro, Roy. D and Heskett, Logistics Strategy: Cases and Concepts (St. Paul, MN; West Publishing, 1985); pp. 6.

However, the changing business environment has forced companies to redefine everything from goals and business process to customers. The traditional concepts of value have had to change as well. The basic idea of logistics providing value merely as a function of time and place utility was no longer adequate to ensure a company's competitive position. The concept and definition began to grow to include the idea of customer service and value-added services.

The concept of value as part of value-added services is an important part of the process of the evolution of definition. The traditional definition, using time and place utility, placed artificial limitations on the value that logistics could provide. The idea of value is being broadened to include numerous tasks that add value: packaging, third party inventory management, bar coding, etc.[29] [30]

The value-added concept redefines the role of logistics as well as further developing the definition of value. Logistics' expanding role begins to include the concept of form utility.[31] [32] Value in logistics includes not only the time and place utilities, but also the value-added services that incorporate the form utility.

The difference between these two types of value is critical to the definition and application of value in logistics. Value is becoming the necessary level of service or product to compete in the market place. Value-added is the extra service that provides

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[29] Ackerman, Kenneth B., "Value-Added Warehousing Cuts Inventory Costs," Transportation & Distribution, Volume 30, Issue 7 (July 1989), pp. 32 - 35.

[30] Witt, Clyde E., "Adding Value Accuracy Equals Quality," Material handling Engineering, Volume 46, Issue 4 (April 1991), pp. 43.

[31] Perreault, William D. Jr., and Russ, Fredrick A., "Physical Distribution Service in Industrial Purchase Decisions," Journal of Marketing, Volume 40, Number 2 (April 1976), pp. 3 - 10.

[32] Ackerman, Kenneth B., "Debuzzing 'Value-Added'," Transportation & Distribution, Volume 32, Issue 9 (September 1991), pp. 60.

competitive advantage.[33] The difference in the definitions is important. The techniques companies use to choose, employ and measure value and value-added functions differ.

The traditional value of time and place utility must be performed to get the product to market. Therefore, the manager must perform that value service. The value-added services provide opportunities and costs that must be evaluated before the company reaches a decision. Also, there are many tools to measure the traditional value type services: on time performance, fill rate, order cycle time.[34] The value-added services are more related to the concept of customer service.

Customer service is another component of value. Customer service partially bridges the gap between value and value-added services. Customer service suffers the same problem as quality with definition. Stock and Lambert state that the "meaning of customer service varies from one company to the next."[35] However, the best definition of customer service states that there are three main components. Customer service as:

1. an activity to satisfy customers' needs,
2. performance measures to ensure customer satisfaction, and
3. a philosophy of firm wide commitment.[36]

Customer service is often used as a substitute for value. Langley and Holcomb discussed how the logistics process creates "customer value."[37] The concept of providing the customer with the basic value and value-added functions is the final step in complete

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[33] Gordon, Jay, "A Textbook Case of Adding Value," Distribution, Volume 88, Issue 8 (August 1989), pp. 103 - 105.
[34] Coyle, op. cit., pp. 94-98.
[35] Stock, op. cit., pp. 113.
[36] Coyle, op. cit., pp. 82-83.
[37] Langley, C. John, and Holcomb, Mary C., "Creating Logistics Customer Value," Journal of Business Logistics, Volume 13, Number 2 (1992), pp. 7 - 11.

customer service. The goal of ensuring customer satisfaction has moved from the area of marketing. Today, it is the center piece of most successful logistics strategies.

Is value synonymous with customer service? Companies have had difficulty finding a definition of value. Customer service provides a more understandable phenomenon. Although both are intangible, customer service is more intuitively understandable. Companies recognize that customer service is measurable and provides returns.[38] Another problem is measuring the value of the third or "philosophy" portion of the definition. This part of the definition is where customer service is a philosophy and is applied in a real world business setting.

To further the association, there is the argument that quality is also a substitute for value. The A. T. Kearney study of Improving Quality and Productivity in the Logistics Process - Achieving Customer Satisfaction Breakthroughs states that total customer satisfaction is only half the equation to creating value. Their premise is that Total Quality Management (TQM) is the other necessary part to successfully increase value.[39] Figure II-1 displays the two ways that logistics creates value in the A. T. Kearney study. To provide value to the customer "Quality" becomes the major component. Therefore, TQM provides another useful and commonly used substitution for value. Just as customer service is a component and synonym for value, TQM is a close fit that is useful for business. TQM provides another more understandable technique with very good measures. Again, quality is a component used to help describe, understand, measure and control value. As Foggin states, "quality and value are related but are not the same

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[38] Sterling, Jay U., "Integrating Customer Service and Marketing Strategies in a Channel of Distribution: An Empirical Study," Ph.D. dissertation, Michigan State University, 1985.
[39] Council of Logistics Management, op. cit. #8, pp. 17-21.

thing."[40] However, for the purposes of this study, quality is a key component that must be included to accurately work with value.

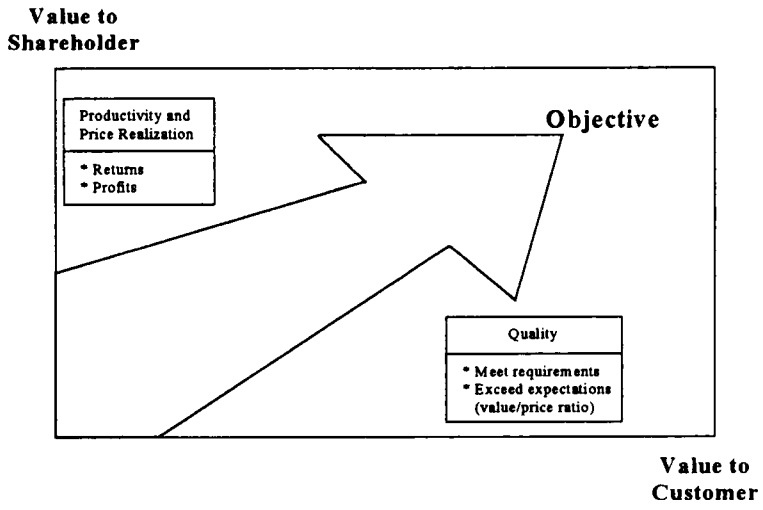


Figure II - 1
The Value Creation Objective[41]

As Figure II-1 shows, the combination of TQM and Customer Service are the key components to creating value. These two areas must be examined to identify how well logistics is performing, measuring and improving value. Authors have been writing about all three parts of the logistics process. However, the key works that will provide a framework for the remainder of the study will be examined in a following section that covers service quality and gaps analysis.

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[40] Foggin, op. cit., pp. 512.
[41] Council of Logistics Management, op. cit. #8, pp. 15.

Logistics Quality

As the previous section identified, "quality" is considered a key component of value. The A. T. Kearney study implies that quality is the primary means to provide the customer with value.[42] The study reinforces that popular belief and study results that quality either creates value or leads directly to profitability.[43]

Just as value is difficult to define, quality has become a very overused and misunderstood term. A recent article in Distribution listed "quality" as one of the thirty misused and misunderstood "buzzwords" used in logistics.[44] The author further stated that, "Not too many years ago, there was a specific definition (of quality), but the word has been all but coopted beyond recognition."[45]

The traditional or dictionary definitions of quality provide some insight into the original meaning of "quality." The Random House dictionary provides a number of definitions of quality and quality control. The most relevant is quality is a character with respect to excellence, fineness, etc., or gage of excellence. Also, quality control is a system for verifying and maintaining a desired level of quality in a product or process by careful planning, use of proper equipment, continued inspection, and corrective action where required.[46]

These definitions begin to show how the logistics quality process can add value. The quality control definition highlights how the proper use of logistical equipment and the management of the entire logistics process is part of quality. The application of quality is providing value to the customer.

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[42] Council of Logistics Management, op. cit. #21.
[43] Ibid.
[44] Muller, E. J., "Buzzwords: Distribution Magazine's Guide," Distribution, Volume , Issue (April 1993), pp. 38-45.
[45] Ibid, pp. 44.
[46] The Random House Dictionary of the English Language (New York: NY; Random House, 1966), pp. 1175.

Another set of definitions are more specific to logistics. Langley and Holcomb imply that quality comes from the ability to provide the "best comparative net value through a combination of efficiency, effectiveness and differentiation of services." Clearly, the first two are major components of implementing quality programs. They further state that these three attributes are combined to create value.[47] A second definition of logistics quality comes from the measurement literature. Novack defines quality as an abstract concept that occurs when a customer's expectations are met regardless of what those expectations might be. In simpler terms, he states "quality is achieved when the customer is satisfied."[48] The third definition comes from the global logistics literature. Patrick Byrne states that in logistics, "Quality means meeting agreed-to customer requirements and expectations including the following dimensions:

- Ease of inquiry, order placements, and order transmission,
- Timely, reliable order delivery and communications,
- Accurate, complete, undamaged orders and error-free paperwork,
- Timely and responsive post-sales support,
- Accurate, timely generation and transmission of information among the functions of the business and with external parties to support the planning, management, and execution of the above activities.[49]

This definition best blends the traditional operational based concept of logistics quality with the new ideas of customer service.

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[47] Langley, C. John and Holcomb, Mary C., "Chapter 9: Total Quality Management in Logistics," Logistics Handbook (New York, NY; Anderson Consulting, 1994), pp. 184.
[48] Novack, Robert A., "How to Calculate the Total Cost of Quality," Distribution, Vol. 88, Issue 8 (August 1989), pp. 108.
[49] Byrne, Patrick M., "Eight Forces for Global Change," Transportation & Distribution, Volume 33, Number 4 (April 1992), pp. 53-54.

By narrowing the focus to logistics and logistical quality the relationship between quality and value becomes clearer. Langley and Holcomb use quality and customer value almost interchangeable. Novack provides a very different concept of customer satisfaction. Earlier, the A. T. Kearney study used quality as the key part of value creation for the customer. These definitions all appear very different on the surface. However, the lack of a clearly accepted meaning of quality allows these different views to work together and allows companies to apply some combination of them.

Muller may have best stated the problem with the over use and misunderstanding of the meaning of quality. The relationship between quality and the creation of value is close. Regardless of a person's view on that relationship, it is clear that the two are inseparable in everyday use. The individual's view of the interaction will be a key part of the level of value that is created by implementing quality.

Service Quality and the Service Quality "Gaps" Model

"Value is in the perception of the purchaser."[50] "Value-added service is something beyond the customary expectation."[51] Both of these quotations demonstrate the importance of the customers' perception or expectation. The goal of any logistics function is to provide quality service and create value for its customers. However, the customer must recognize that value exists. If the customer does not acknowledge the value, no amount of quality or service will increase the profitability of the firm.

The transition from value and value-added to customer service and quality is a logical step that makes the nearly impossible task of identifying and measuring value

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[50] Direct quote by James Adams II as told to Muller, E. J., "The Strange Case of Added Value," Distribution, Volume 89, Issue 1 (January 1990), pp. 32.

[51] Direct quote by William Tickle as told to Muller, E. J., "The Strange Case of Added Value," Distribution, Volume 89, Issue 1 (January 1990), pp. 32.

possible. The next logical step is to combine these two areas. The goal of this subsection is to illustrate how the Service Quality Model can be used to combine quality and customer service into a working model that allows researchers to identify and measure value for the customer. The idea of service quality is conceptually reasonable based on the combination of customer service and quality.

The Service Quality Model provides a reasonable representation of the logistical process of providing service to the customer.[52] The authors used the term marketer in the actual model. The model's process of delivering service to the customer can depict the logistics functions that add value as well.

The Service Quality Model (Figure II-2) identifies five key gaps that exist throughout the entire process of satisfying the customer's need and providing him value. The model is divided into internal and external areas. Three of the gaps are internal to the firm and two include the customer. Each of these gaps identifies an important area that needs to be addressed to not only provide value, but also to ensure that the customer recognizes the value and value-added service he is receiving.

Gap 1 deals with the differences between the consumer's expectation and management's perception. There are significant incongruencies between what the customer actually wants and what the managers believe the customer wants. The service providers have either forgotten what the customer really needs or concentrate on services that are not adding any value. The article listed three examples that dealt with privacy, security and firm size where the managers were completely off base with their beliefs when compared to the customer's requirements.[53]

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[52] Parasuraman, A., Zeithaml, Valarie, A., and Berry, Leonard L., "A Conceptual Model of Service Quality and Its Implications for Future Research," Journal of Marketing, Volume 49 (Fall 1985), pp. 41-50.

[53] Ibid.

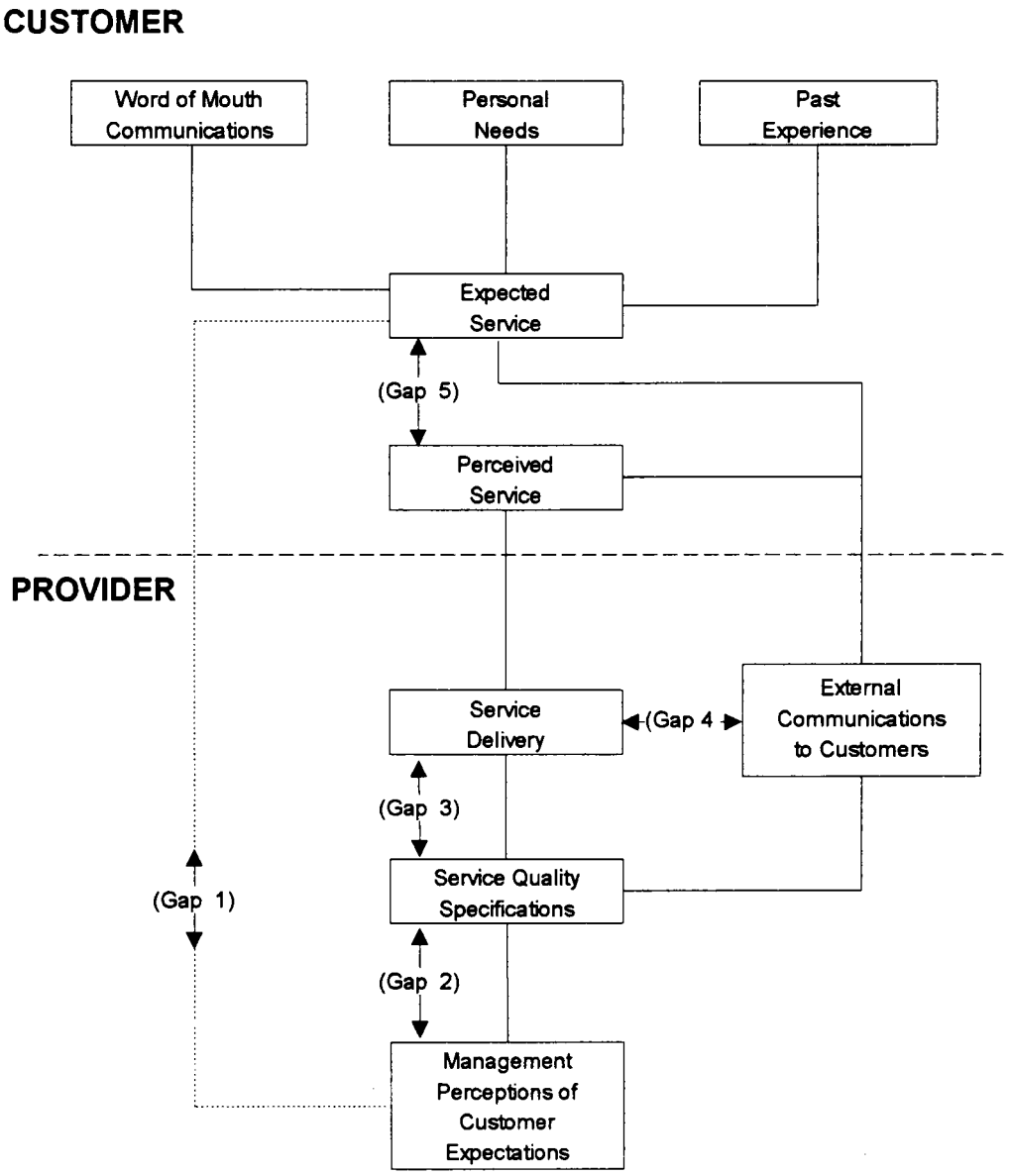


Figure II - 2
Service Quality Model: The Gap Model[54]

Gap 2 is internal to the company providing the service. This gap covers difficulties of the translation of management strategy into service quality specifications. The creation

[54] Ibid, pp. 44.

of guidelines and criteria is a difficult process. The company is attempting to measure the value it is creating and adding in its process. The propose of this work is to attempt to clarify some of this confusion. This gap will be further addressed in the measurement area.

Gap 3 deals with the gap between the service quality specifications and the actual service delivery. This gap addresses the variation of the individuals performing the actual function. Even when clear and measurable criteria are created, the operators performing the services cause variation due to errors, training, poor performance, etc. A quotation from a manager shows the difficulty of individuals. "Everything involves a person. It's so hard to maintain standardized quality."[55]

Gap 4 is the last of three internal gaps (Gap 2,3,4). It covers the break down of communicating actual service with the sales or advertising force's promises. The service delivery and external communications gap is very important in helping the customer identify what should be the correct level of service or value. This is an internal gap because the differences occur between operations and management's capabilities and the company's customer contact point. The contact point, whether advertising or customer service, must be well informed on the proper levels of service quality that the firm can provide. As one study showed, many customers view an honest and competent salesperson as the single most important factor.[56]

The final gap is Gap 5: the customer's difference between expected and perceived service. It is clearly the most difficult to identify and quantify. This gap is completely external to the firm. The customer internalizes his evaluation of the service and compares

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[55] Ibid., pp. 45.

[56] Sterling, Jay U. and Lambert, Douglas M., "Establishing Customer Service Strategies within the Marketing Mix," Journal of Business Logistics, Volume 8, Number 1 (1987), pp. 1 - 31.

it to his expectations about the level of service he expected. Normally, he fails to express his satisfaction or dissatisfaction except with his pocketbook. Typically, it is only the few customers on the extreme edges that are either extremely pleased or upset with the value of the service. These customers provide most of the input back to the firm to help close this gap.

A serious problem arises when trying to measure Gap 5. Since it is internal to the customer, it is very difficult to assess the differences in perceived service and expected service. If the customer does not express his satisfaction or dissatisfaction with the value provided by the firm, the company receives no feed back to use as a basis for improvement. Authors have stated that Gap 5 can be closed through market research, benchmarking, good design, adequate control and good information feedback.[57]

The Service Quality Model provides a beginning point to identify methods to measure the value of logistics. The model emulates the logistics process. By developing measures to close the different gaps, a quantification of the value of logistics may be developed for use by academics and practitioners.

Lambert, et al. provide a newer view of the Service Quality Model in Figure II-3. Their modification included a new area under the vendor's portion of the model. They add the Management Perception of the Firm's Performance. This new area creates four additional gaps to the model. These gaps add both internal and external areas that need to be measured.

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[57] Foggin, op. cit., pp. 529.

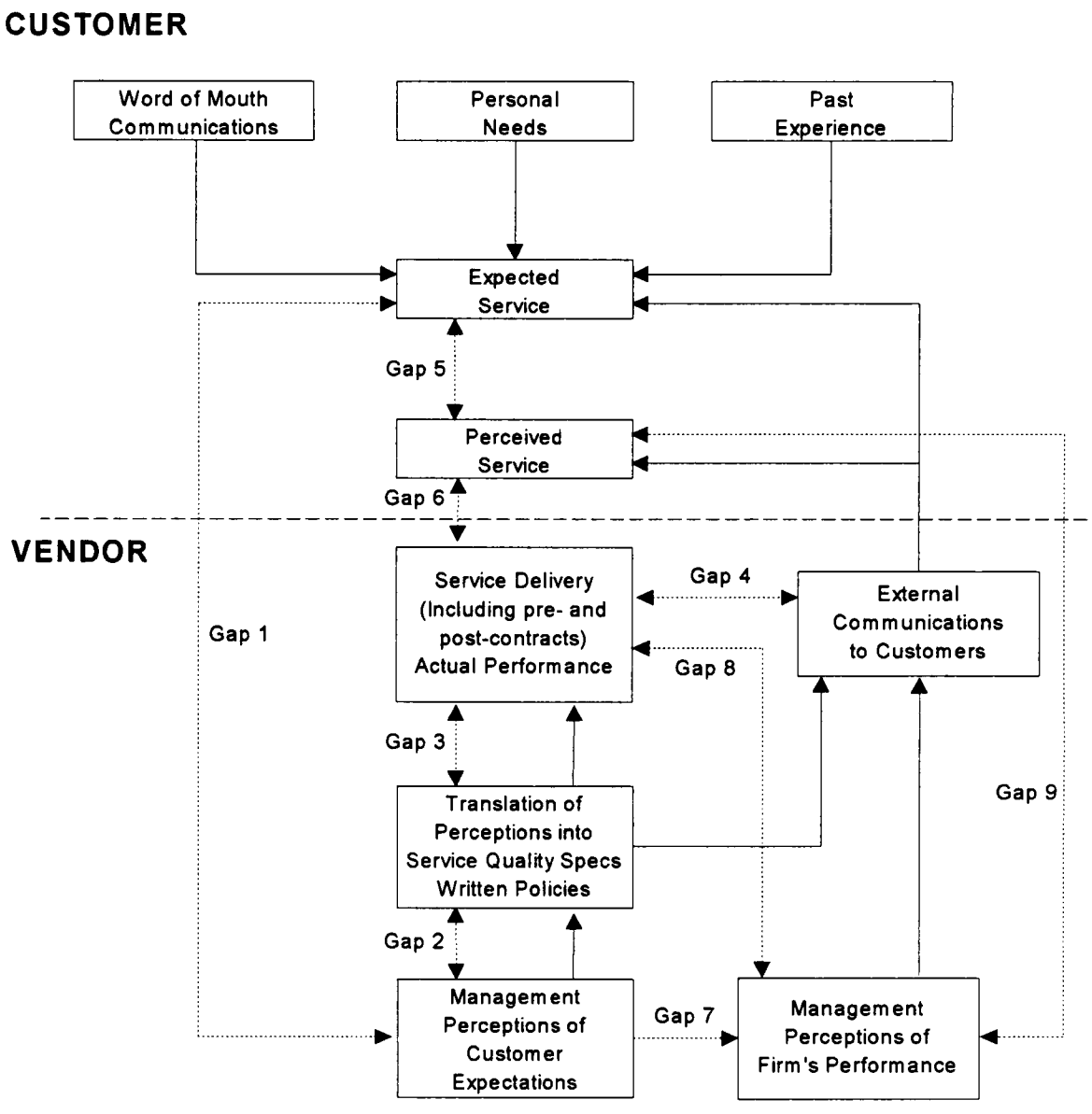


Figure II - 3
Service Quality Model[58]

[58] Lambert, Douglas M., Stock, James R., and Sterling, Jay U., "A Gap Analysis of Buyer and Seller Perceptions of the Importance of Marketing Mix Attributes," in 1990 AMA Educators' Proceedings, Chicago: American Marketing Association, pp. 208.

Gap 6 compares the actual performance of the delivered service with the customer's perception of that service. The actual performance can be measured using the standard techniques of on-time performance, fill rate, etc. The more difficult portion is the measurement of the customer's perceived level of service. Regardless if the item is on-time, if the customer believes that it was late, the end result is the service failed and was late. The difficulty lies in measuring the customer's perception.[59]

Gap 7 identifies the difference between the managers' perceptions of the customers' expectations and the managers' perception of the firm's performance. Gap 7 is internal to the firm and deals with management's perceptions. Therefore, it is extremely difficult to accurately quantify the two sets of perceptions and compare them.[60]

Gap 8 compares the Management Perceptions of Firm's Performance with the Actual Performance. This internal assessment should be quantifiable. The normal attribute measures of service quality can be compared with the perceptions of the management.[61]

Gap 9 is the new gap that is external to the firm. The Management Perceptions are contrasted with the Customer Perception of Service. This comparison is just as difficult to compare as Gap 7 for the same reasons. The comparison of two perceptions is difficult.[62]

Both versions of the Service Quality Model present frameworks to help measure the value of logistics. Although the task remains difficult, logistics can provide the services to close many of the gaps identified in the models. The ability to measure the logistics functions used while closing those gaps will help to demonstrate the value created

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[59] Ibid.
[60] Ibid.
[61] Ibid.
[62] Ibid.

by those functions. As stated previously, the measures may quantify quality or customer service, but they are reasonable substitutes for value and value-added services.

Measurement

Although it is customary to discuss most measurement concepts in the methodology chapter, a review of the many attempts to measure customer service and quality is appropriate to this chapter. Numerous authors have unsuccessfully attempted to provide the definitive measure of customer service. At the same time, TQM includes a comprehensive set of measures that provide very accurate quantitative tools. The remainder of this section will focus on logistics attempts to measure these areas. This section will not define the measures or tools used for this study. The methodology chapter will identify the techniques used.

There have been a number of studies quantifying different parts of the logistics customer service elements. One of the first articles was by Simon in 1965. Simon used interviews and the least square method to examine five measures of customer service and expressed satisfaction. This work established a relationship between performance and satisfaction.[63]

Willett and Stephenson attempted to link supplier service with the customers' evaluation of that service. Their key measures were the reorder cycle service time with the satisfaction with that specific service time. Regression was applied to the returned data from their mail questionnaires. They determined there was a linear relationship

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[63] Simon, L. S. "Measuring the Marketing Impact of Technical Services," Journal of Marketing Research, Volume 2, February 1965, pp. 32 - 39.

between the two areas and both the supplier and customer could discriminate between small differences in the established service time.[64]

Ballou continued the work by conducting a mail survey to identify the effects of variation in the order cycle time with the change in the percentage of sales. He used both linear and non-linear regressions to examine the purchasers' responses to the changes in the logistics systems. Where Willett and Stephenson identified a linear relation between service time and satisfaction, Ballou found a non-linear relationship. He showed that the average order cycle time was more important than variability.[65]

Another method used was trade-offs. This seems particularly appropriate since so much of logistics is a series of trade-offs (i.e., transportation verse inventory, inventory effect, transportation effect, etc.). Three different articles either used or mentioned this technique: Perreault and Russ, Levy, and Foggin. (To maintain chronological order, Levy and Foggin will be covered later.)

Perreault and Russ presented the first real use of trade off matrix and conjoint analysis. They wrote a series of articles that covered physical distribution and conjoint analysis. The end result was to compare trade-offs of service factors with the preferences of the customers by a mail survey. The results validated earlier studies and verified that the conjoint analysis technique not only worked, but was especially effective in situations with a large number of very similar choices in a middle range.[66] [67] [68] [69]

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[64] Willett, R. P. and Stephenson, P. R. "Determents of Buyer Response to Physical Distribution Service," Journal of Marketing Research, Volume 5, August 1969, pp. 279 - 283.

[65] Ballou, R. H., "Planning a Sales Strategy with Distribution Service," The Logistics and Transportation Review, Volume 9, Number 4 (1973), pp. 323 - 333.

[66] Perreault, William D. Jr., and Russ, Fredrick A., "Physical Distribution Service: A Neglected Aspect of Marketing Management," Michigan State University Business Topics, Volume 22, Number 3 (Summer 1974), pp. 37 - 45.

[67] Perreault, William D. Jr., op cite #14.

Another appropriate technique to logistics is the use of simulation. Gilmour applied sensitivity analysis with simulation to compare a large number of customer service performance measures and market share. The results of the study showed the relationship between customer service and demand response. Managers' predictions of growth rate and the simulation were very close.[70]

The group of Uhr, Houck and Rogers used factor design to analyze three measures of customer service effect on profit. Their mail survey reaffirmed the importance of order cycle time and variability on the profitability of a firm. Also, communication was found to be non-significant which questions Gap 4 of the Texas A&M Model. The real contribution to the field was the inclusion of the previously non-traditional statistical method of factor analysis.[71]

The next continuation of advances in methodology was the use of multivariate non-linear regression by Morey, who compared retail services to the change in sales. The goal was to show the relationship between service variables and the effect on sales. The major finding was that the service levels were related to sales, but at a diminishing rate.

As stated previously, Levy continued the trade-off analysis. Levy studied the effects of logistical services and the customers' perception. The use of conjoint analysis by a mail questionnaire showed that the fill rate and terms in sales were the highest items to

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[68] Perreault, William D. Jr., and Russ, Fredrick A., "Quantifying Marketing Trade-offs in Physical Distribution Policy Decisions," Decision Sciences, Volume 7, (Summer 1976), pp. 186 - 201.

[69] Perreault, William D. Jr., and Russ, Fredrick A., "Improving Physical Distribution Service Decisions with Trade-off Analysis," International Journal of Physical Distribution and Materials Management, Volume 7, Number 3 (1977), pp. 117 - 127.

[70] Gilmour, P., "Development of a Demand Response Function," Journal of Business Logistics, Volume 1, Number 2 (1979), pp. 83 - 102.

[71] Uhr, E. B., Houck E. C., and Rogers, J. C., "Physical Distribution Service," Journal of Business Logistics, Volume 2, Number 2 (1979), pp. 158 - 169.

effect the response of the customer. This article reaffirmed the use of conjoint to asses the trade-offs in logistics.[72]

Ross and Lusch added multiple regression with correlation. They linked logistical customer services provided by brokers to the customers' satisfaction with the broker. Their major finding was that high quality service helped to create satisfied customers. This is an interesting case that helps to demonstrate that value creation combines quality and customer service. Ross and Lusch showed some of the relationship between value and customer service without specifically identifying the value creation.[73]

Ozment and Chard furthered the measurement process by comparing a set of customer measures to the different divisions' sales over a four year set of data. They also controlled price and promotion to show the actual impact of customer service. The use of ordinary least squares showed that the cycle time and fill rates were non-significant at the alpha equals .05 level. This is counter intuitive to the concept that logistics adds value, particularly beyond the traditional definition of time and place utility.[74]

As stated previously, Sterling and Lambert added to the measurement techniques. Their major contribution dealt with the scale created, used and verified to measure customer service. However, all the actual scales will be covered in the methodology section: SERVQUAL through the 99 variables of Sterling and Lambert. A second contribution was the inclusion of using stepwise multiple regression to compare the customer service measures to market share. The results identified a combination of the

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[72] Levy, M., "Toward an Optimal Customer Service Package," Journal of Business Logistics, Volume 2, Number 2 (1981), pp. 87 - 109.

[73] Ross, R. H., and Lusch, R. F., "Logistical and Promotional Services and Wholesaler-Broker Satisfaction," International Journal of Physical Distribution & Materials Management, Volume 13, Number 1 (1983), pp. 56 - 64.

[74] Ozment, J., and Chard, D. N., "Effects of Customer Service on Sales: An Analysis of Historical Data," International Journal of Physical Distribution & Materials Management, Volume 16, Number 3 (1986), pp. 14 - 28.

quality and number of customer service functions performed effected the market share of the company.[75]

Another group of researchers attempted to demonstrate how logistical customer service practices could impact on the sales for a specific division. From historical data, Darden, Davis and Ozment used the general linear model to reassert the high level of effect of price and logistics responsiveness on sales. This is contradictory to the non-significant findings of Ozment and Chard. The logistical customer service variable of responsiveness had a relationship with sales. However, they were in agreement that some of the logistical customer service variables of product availability and reliability did not have a recognizable impact on sales.[76]

Next, Pisharodi and Langley applied canonical correlation analysis to manufacturers and their customers. Their mail questionnaires to pairs found that there was a strong relationship between measures of customer perceptions of customer service and market response. However, they were unable to find a similar relationship between measures of manufacturer perceptions of customer service and market response.[77]

Foggin approached the problem of measuring customer service from a unique angle. He used the Service Quality Model's Gaps as opportunities to apply quality measures like statistical process control (SPC). Total Quality Management measures could help managers to benchmark, redesign, control and monitor results of a company's customer service programs.

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[75] Sterling, op. cit.

[76] Darden, William, R., Davis, Grant, M., and Ozment, John, "The Impact of Logistics on the Demand for Mature Industrial Products," European Journal of Marketing, Volume 23, Issue 2 (1989), pp. 47 - 57.

[77] Pisharodi, R. Mohan and C. John Langley Jr., "Interset Association Between Measures of Customer Service and Market Response," International Journal of Physical Distribution and Logistics Management, Volume 21, Number 2 (1991), pp. 32 - 44.

The conflicts in results further highlights the problem of the value of logistics. He also demonstrated the usefulness of a modified trade off or forced ranking matrix similar to conjoint analysis.[78]

Kirk viewed customer service measurement through the use of case studies. The results of the study were inconclusive. However, it did highlight the lack of customer service measures of a "leading" logistics company. The DuPont study stated that the company had no customer service measures, no integrated logistics system nor a cost system to measure the logistics division of the company.[79]

One final study uses relational marketing customer service as the basis for identifying value. Woodruff, Schumann and Gardial attempted to measure the value of service based on their model. Figure II - 4 demonstrates how the value of the service is normally measured based on the attributes, benefits and values of that service. This model reaffirms the difficulty in measuring actual value, but presents a reasonable method to load different attributes on to the values that they create to satisfy the customers need.[80] This technique could be employed in business-to-business situations. The relationships between logistics companies and other firms could be identified by this method as part of the overall quantification process.

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[78] Foggin, op. cit.

[79] Kirk, S. V., "Distribution of Engineering Polymers to the UK and Eire," International Journal of Physical Distribution & Logistics Management, Volume 20, Issue 4 (1990), pp. 37 - 46.

[80] Woodruff, Robert B., Schumann, David W., and Gardial, Sarah Fisher, "Understanding Value and Customer Satisfaction from the Customer's Point of View," University of Tennessee Survey of Business, Volume 28, Number 1 (Summer / Fall 1993), pp. 33 - 40.

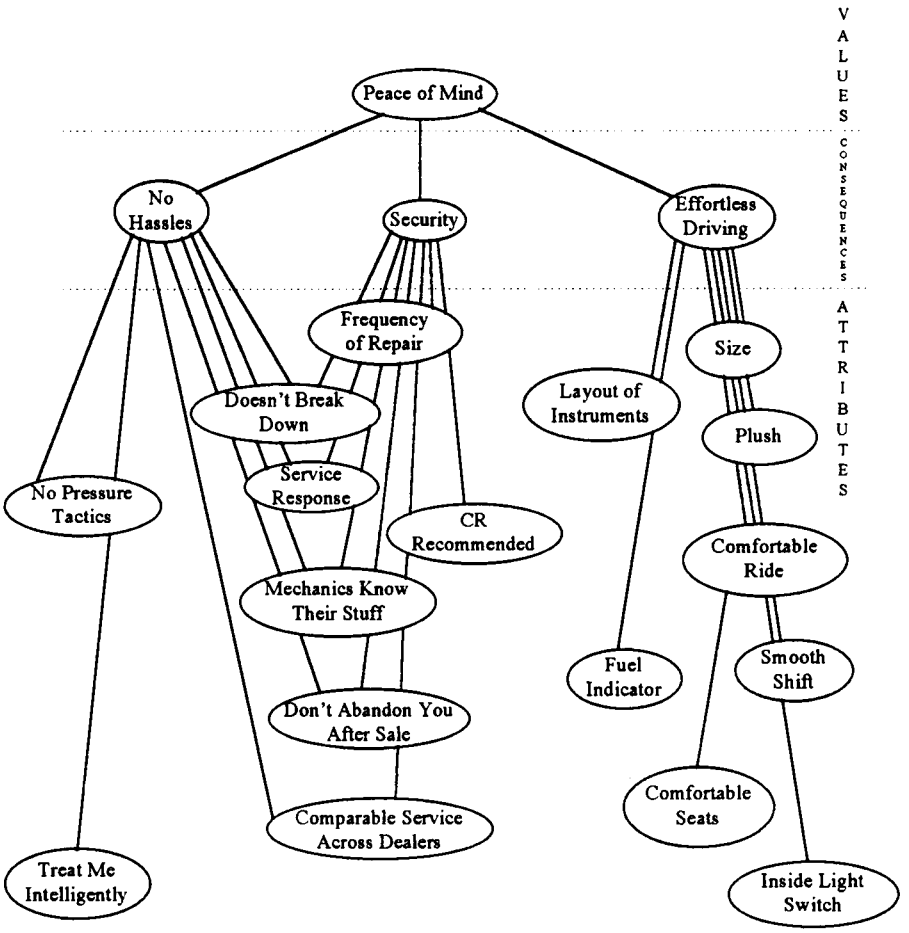


Figure II - 4
Customer's Means-End Value Chain[81]

This model presents a different view on the measurement of value. Although it is still a very qualitative model, it provides a methodology to examine the true value a customer requires from a product or service. The example model displays that the value a

[81] Ibid.

customer demands from a new car is a "peace of mind." Clearly, most automobile manufactures would not consider this the primary concern of the buyer. The attributes of size, ride, service and comfort are the items that companies normally focus upon. This model represents a new method of measuring the relationships between values and attributes.

The total collection of studies presents an overview of the development of the measurement of customer service as it relates to logistics. The results of the individual studies are not as important as the evolution and application of different techniques. Many different statistical methods and models were applied with various levels of quantification success.

The overall results determined many of the key attributes to providing customer service. However, the studies failed to identify how these attributes provide value to the actual customer or the company's shareholders. This area of value must be examined.

Summary

The literature of customer service provides a valid surrogate to value in many areas. The actual value may or may not be determined. However, the attributes provide indicators of the value that is being created.

These attribute measures provide a starting point for further study. By building on the previous literature and studies, there are many methods to attempt to quantify the actual value. Logistics has made significant progress in the last twenty years in measuring attributes. The key advance is the ability to measure the actual value that these attributes create for the customer. The actual measurement of the value, not attributes, is an area that needs further development in logistics and throughout business in general.

Chapter III - Methodology

Introduction

The goal of the methodology chapter is to present the propositions to be tested and the research tools that will be used. The research design and methodologies used will be discussed and evaluated. This chapter will describe how the major research questions will be answered by the techniques employed during the study.

How do companies quantify the value that logistics creates? That is the major research question that this dissertation seeks to understand. This chapter identifies the best method, appropriate to our current level of understanding, to investigate this area. The research questions are combined with the literature review to determine the approach needed to further the body of knowledge. This chapter lays out the correct method or methods, and presents the necessary details to conduct the study.

There are a number of major sections to this chapter. First, the objectives of the research are discussed. Second, the general research plan is depicted both in writing and visually. This describes each of the major phases of the research. Next, the chapter states the research methods and catalogs the strengths and weaknesses of the methodology. Then a section covers how the research questions are converted to propositions and hypotheses. The last sections cover the data analysis techniques and a conclusion to this chapter. The appendixes include the measurement instruments and list of case study participating companies.

Research Objectives

The previous chapters identified a number of opportunities for research. The definition of value has not been clarified. Also, the inability of logistics managers and

academics to accurately measure value is still a problem. Next, there are some companies that have had some success of quantification, but academia is somewhat unfamiliar with these techniques. Furthermore, the companies that have had some success have not shared their techniques throughout industry. Finally, the study will examine if the methods in practice today are generalizable or applicable.

This section describes the objectives of the research to address each of these areas. The first objectives will help to provide understanding of value and its quantification. The remaining objectives will cover the best practices and generalizability. The objectives are presented to demonstrate the general concept of the research.

The first objective is to examine the actual definition of value and value-added in the field of logistics. These terms are becoming "buzz" words, yet logisticians are unable to agree on the meaning.

O_1: The research will help to determine a common working definition of what is logistics value beyond time and place utility.

- Do logistical organizations have a definition of the value that they create for their companies? Do companies have mission statements that specify the contribution of logistics within their organization?
- Is there a difference between value and value-added in both meanings and in actions in logistics?

The second objective of the research is to attempt to quantify the value that will be defined by objective one. The techniques, methods and models used by industry can provide a basis for examination.

O_2: The research will determine methods used by companies to quantify the value and value-added of their logistical services.

- Is there are common method that is used by many companies?
- Are companies measuring attributes, consequences or values in their quantification methods?
- Are the companies quantitatively measuring attributes or customer service as a substitute of value?

A third objective is to identify the best practices in use today. The companies that have had success quantifying value will be compared to examine which methods can be considered as the "best practices."

O_3: The research will analyze the best practices of logistics value that should occur in a number of companies' quantification techniques and should be studied for common traits.

- Do the companies that have had success measuring the value of logistics also have financial success (i.e., ROI, market share, profits, etc.)?
- Is there a single prevalent method?
- Do the companies that have had success with quantification have common characteristics or demographics?

The final objective of the research is to generalize the findings of the rest of the work. Can the traits used by some logistics firms be applied broadly to improve the entire logistics industry?

O_4: The research will examine the techniques used by the companies to quantify the value of logistics to determine the level of generalizability.

- Are the methods used by the companies totally transferable between different companies or only portions?
- Can the different techniques be combined?

- Should companies attempt to use these methods or should they develop their own systems?

This section has attempted to identify four areas for examination. The research objectives present the goals of this research. Each area will be examined to develop the information that will be collected into useful concepts and models. If these objectives are successfully completed, it will lay the foundation for the eventual understanding of value, value-added and logistics value.

Research Plan

The literature review shows that numerous techniques have been used to measure logistics' value. Some of the authors discussed in Chapter II have substituted customer value attributes to attempt to understand more about the value of logistics. As many of the previous studies indicated, the actual value created by logistics still is unclear. This research will build on the previous works. Rinehart, Novack and Langley's recent research identified the value shortcomings of the previous works.[82] The Rinehart, Novack and Langley study is the starting point in this research. Figure III - 1 presents the steps in the general research plan. The figure displays the two major phases of the research plan: exploration and confirmation

To further clarify the different phases, the exploration phase will be referred to as the CLM case studies and survey. The confirmation phase, this author's main focus, will be called the dissertation survey. This should ensure clarity throughout the chapter.

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[82] Novack, Robert A., Rinehart, Lloyd M. and Langley, C. John Jr., "An Internal Assessment of Logistics Value," Journal of Business Logistics, Vol. 15, No. 1 (1994), pp. 113 - 152.

Considering the initial survey in the Rinehart, Novack and Langley study, the results identified the lack of ability of most logistics managers to quantify the value of logistics. The analysis of that work provides the basis for both the CLM research and this dissertation. Since the value has not be accurately measured by most firms, the opportunity to study this area drives the rest of the research design.

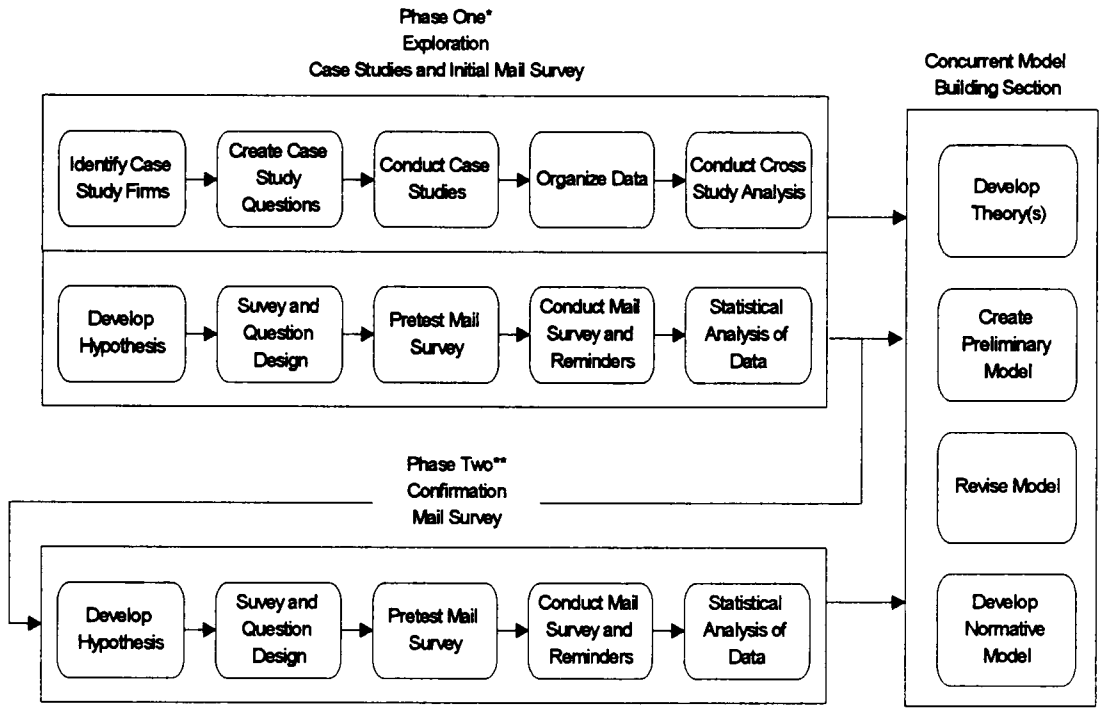


Figure III - 1
Research Plan

Phase I: Exploration (as part of the CLM Study)

The Council of Logistics Management (CLM) agreed that this was an important area to examine. CLM funded the continuation of the previous research of Reinhart,

Novack and Langley by supporting a research team. This team included members from Michigan State University, Pennsylvania State University and the University of Tennessee. The team's objective was to determine how companies identify logistics value and how they quantify the relationship between logistics service/cost improvements and a firm's revenues/profits. The CLM study consisted of a group of case studies and a concurrent mail survey. This is depicted as Phase One, exploration, in Figure III-1.

The diagram shows that a logical next step was to identify firms that have had some success quantifying the value. These companies reported the ability to measure logistics value by various methods. These firms became the leading firms by default. Since there appeared to be no other companies that had success, those organizations that made some progress presented the best examples for study.

Those successful companies were pared down to a manageable number for examination by the CLM team. The number of case studies in this study was limited. The team choose ten companies due to the practical considerations of travel time and expense, the number of likely candidate companies, and scheduling interviews. In most cases, the list of firms reported measurement success and agreed to participate in further study. The group was large enough to allow some flexibility in choice. The number was reduced based on past history of the companies, analysis of respondents' methods and practical considerations. A list of the selected case study companies is included in the Appendix A.

The next step was to conduct the case studies. The initial studies had a number of goals. The CLM study attempted to gather data that meet the objectives stated previously. The results identify some of the "best practice" methods of quantifying value. This researcher also had the secondary goals of using the case studies for standardization and pretesting for further research.

The format of the case studies process followed traditional interview techniques. The first case study was conducted with all the interviewers present. The first case study provided a common basis to conduct and compare further interviews. The second point of the early interview was to pretest the interview guidelines. The exploratory nature of the study implied an iterative process of evolution throughout the first few sessions. The early studies identified new areas not previously considered that required further examination. This was a critical step for the success of the entire study.

The remaining case studies provided the necessary data to complete the first part of the CLM study. The case studies were conducted over as short as time period as possible to reduce any effects of time. The collection of case data by different researchers complicated the problem. Complete transcripts of the interviews would have reduced confusion and different interpretations of the data. However, most companies were unwilling to allow the taping of conversations due to the sensitive nature of data and comments.

The final step of the case study portion of CLM phase was the analysis of the case study data. This work attempted to verify propositions from the methods applied by the companies. Considering comments of the firms, the concept of value, value-added, logistics value and measurement were clearer. General observations and reoccurring themes will be highlighted in the Case Study Chapter.

The other portion of phase one, CLM study, was related to the results of the case studies. The CLM survey attempted to generalize the expected results of the case study phase. The key points suspected in the case study phase were examined in a national survey. Not only did this help generalize, it also validated whether the methods used by the case study companies were useful. This phase required a number of steps to complete the study.

The first was to develop the survey. This instrument was to capture the essence of the interviews' main points. At this point, a survey was methodologically appropriate. However, some of the actual questions were designed after the first case study analysis. The basic design of the survey was based on the survey design methods of authors like Dillman, Kerlinger, Sudman and Bradburn.[83] [84] [85]

The next step was to pretest the survey instrument. The pretest was to determine if the questions were capturing the ideas and concepts that the case studies identified. This step involved individuals at different universities and industries. The plan included a number of different opinions to ensure the survey was complete and representative. This step lead to some redesign of the initial survey. The modified survey was then pretested. This was continued until both the pretesters and researchers were comfortable with the survey instrument's ability to measure the concepts.

Once the pretest and modification steps were complete, the actual survey was conducted. The Council of Logistics Management membership list provided a good list of companies and individuals. These members provided a reasonably representative body to test any theories or hypotheses. A total of 1,600 plus companies provided the sample. Assuming value was being measured by industry, the CLM survey provided large amounts of useful data to test concepts.

The data collected was analyzed by the CLM team and will be further analyzed for testing of earlier theories by this author. Various analytical and quantitative techniques will be used. This is the first step that will support the use of statistical methods to

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[83] Dillman, Don A., Mail and Telephone Surveys: the Total Design Method, (New York, NY: John Wiley and Sons, 1979); pp. 1 - 325.

[84] Kerlinger, Fred N. Foundations of Behavioral Research, Third Edition. (Fort Worth, TX: Harcourt Brace Jovanovich College Publishers, 1986); pp. 377 -388.

[85] Sudman, Seymour, and Bradburn, Norman M. Asking Questions (San Francisco, CA: Jossey-Bass Publishers, 1982); pp. 261 - 376.

examine the data. This stage will apply T-tests, one-way analysis of variance and multiple regression to determine significant findings and relationships. This will be the last step of the survey portion of the CLM team phase of the research.

Phase II: Confirmation (Dissertation Study)

Phase II is the follow-up research doneby the CLM team. The goal of this phase is to confirm specific findings of the early research. Also, it will build upon the earlier findings to increase the understanding of the "value" of logistics. The first phase of the research does not answer all of the research goals described by this researcher. A key part of this second phase will be to answer this author's remaining questions not covered in the CLM study.

This phase will reuse the CLM mailing list and to conduct a follow-up survey (dissertation survey). The dissertation survey will be much shorter and tailored to gather overlooked information from the CLM survey and to collect new data specific to this author's research. The analysis of the CLM and the dissertation sets of data will be conducted to answer the hypotheses later in this chapter.

Phase III: Model Development

The CLM study and dissertation study are sequential. However, there is a third part to the research design. This section is the model development section. The CLM team and this researcher developed a working, conceptual model at the beginning of the case study phase as a guide to the interview format. This model was refined into a preliminary model by the end of the case study phase. The dissertation study will allow specific testing of the preliminary model by analytical means. The dissertation phase will

provide input for further refinement and development of the model. This section will provide the necessary information to complete the model.

The completion of the dissertation survey phase and the refinement of the model will end this research. Figure III-1 visually represents the entire research process. This research plan presents a logical step by step plan that should help move from a very limited understanding to a clearer comprehension of the logistics value.

This dissertation will present the findings of all phases of the research. It will provide both CLM case study/survey as well as dissertation results to provide an extensive understanding. The CLM team is responsible for much of the gathering and interpretation of early research. However, this author is responsible for generating the vast majority of the data and analysis in this work.

Research Methods

Case Studies

Since one of the goals of the first phase was to understand, case studies with in-depth interviews provided the best method. The majority of CLM study was an attempt to determine how companies do business. How do they define value? How do they quantify their value of logistics? Also, why do they perform this quantification process?

Yin stated that the research method is dependent on the question the researcher asks. He indicated that case studies were appropriate for the "how" and "why" type questions. The case studies approach allowed for the study of phenomenon in the real life context. The open ended type questions provided more depth of understanding.[86]

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[86] Yin, Robert K., Case Study Research: Design and Methods, Revised Edition (Sage, Newbury Park, Volume 5, 1989); pp. 14 - 20.

Other authors also support the use of case studies. Bonoma discussed the advantages of case studies. He stated that case studies are useful to describe and compare processes. Also, the case studies were useful in determining the causation and association type relationships of the concepts being studied.[87]

Babbie discussed the advantages of case studies. He stated that field research is useful to describe and understand phenomenon. Furthermore, he emphasizesd that the use of field studies was helpful in understanding a process that hasd many sources of input into a process. The most appropriate field study was a case study.[88]

Eisenhardt also supported the use of case studies. She stated that a case study would help to understand the relationship at one location. Also, she said that case studies were appropriate for studying new concepts or areas. This was appropriate for areas that have not been developed fully, such as the value of logistics.[89]

Based on the recommendations of the previous authors, case studies with in depth interviews appeared to be the best choice. The lack of understanding of the value of logistics implied the "how" and "why" type questions. The companies that have had some success in understanding provided good case studies. The understanding and description of their processes helped to create a foundation of knowledge.

Data Collection

The data collection came from in depth interviews. Yin suggested the use of a semi-structured interview allowed the participants to add their own insights and

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[87] Bonoma, Thomas V., "Case Research in Marketing: Opportunities, Problems and Process," Journal of Marketing Research, Volume XXII (May 1985), pp. 199 - 208.
[88] Babbie, Earl, The Practice of Social Research, Third Edition (Belmont, CA: Wadsworth Publishing, 1983); pp. 482.
[89] Eisenhardt, Kathleen, "Building Theories from Case Study Research," Academy of Management Review, Volume 14, Number 4 (1989), pp. 532 - 550.

observations. This created two types of interviewees: informants and respondents. The informants' replies added more to the interview process. These individuals contributed to the concept development by including ideas and experiences that created new theories. The respondents either verified or disproved existing thoughts.[90]

These interviewees were chosen based on the findings of an earlier study of Rinehart, Novack and Langley.[91] The companies that had reported some success at quantifying logistics were considered the "leading edge" firms. The designation of the leading edge was realistic based on the conclusion that value is important to logistics and business. The companies that were attempting to understand and apply their knowledge were the leading edge at the time of this study. The practical application of the leading edge status was the ability to adapt and apply a proven research technique. The Bowersox, et al. CLM study of leading edge logistics provided a blue print for this study. Earlier sections of this dissertation presented a modified model of the research process that was so successful for Bowersox, et al.[92]

The leading edge companies were further reduced by their willingness to be interviewed. It was unlikely that an unwilling participant would have provided useful information. The remaining firms were ranked based on the experience of other university's professors to determine the most likely candidates for case studies. Considering the real world practicalities of travel, cost, time, etc., the research team conducted ten interviews (Appendix A - Case Study Participating Companies).

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[90] Yin, op. cit., p. 84.
[91] Novack, op. cit.
[92] Bowersox, Donald J., Daugherty, Patricia J., Droge, Cornelia L., Rogers, Dale S. and Wardlow, Daniel L., Leading Edge Logistics: Competitive Positioning for the 1990's, (Oak Brook, IL: Council of Logistics Management, 1989); pp. 65 - 90.

The case study number was flexible based on informers input during the early interviews. It was reasonable to expect some modification to the interview format and even concept formulation based on the informers' comments. The process was very iterative in the early stages and highlighted the need to ensure a number of industries were interviewed. Mandrodt presented a useful model of how the process changed the concepts and interview format based on the early interviews.[93] Figure III - 2 displays the iterative process.

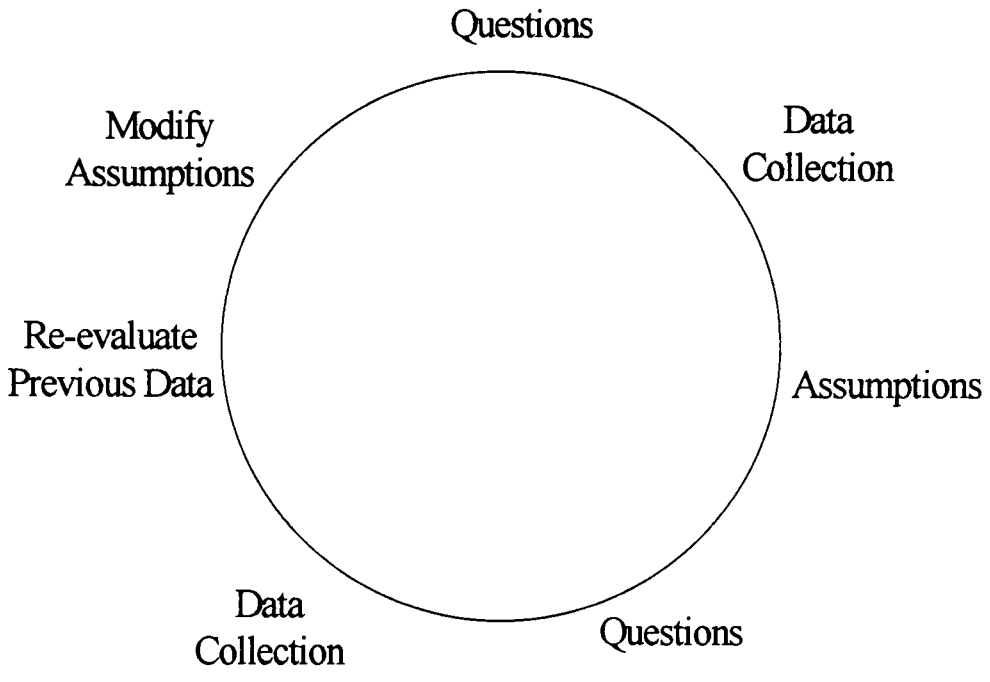


Figure III - 2
Iterative Research Process[94]

[93] Mandrodt, Karl B. Service Response Logistics: A Case Study of Financial, Health Care, and Contract Logistics Organizations (Knoxville, TN: Unpublished Doctoral Dissertation, 1993), pp. 62.
[94] Ibid.

The iterative process is accepted by various authors with some reservations. The major problem is comparison of earlier and later interviews or cases due to change. Eisenhardt supported the changing or altering of data collection techniques during a study.[95] This was also supported by Yin's methodology of case study collection and analysis process. His process included a reassessment after each case study to reexamine and develop the theory. This lead directly to choosing the data collection plan.[96] The researchers had to ensure that a sufficient number of cases were conducted all using the same format to allow useful interpretation.

The case studies were conducted at the companies' locations with various levels of management. The goal was to deal with the highest level logistics manager, as well as the support personnel within the division. The open ended questions allowed these individuals to present their companies' techniques for quantification. The support personnel provided verification, company data and specific examples.

The interview guide (Appendix B) for the case studies was based on the previous study of Rinehart, Novack and Langley. This group of authors formed the nucleous of the CLM research team that examined the difficulties of quantifying the value. The previous study and relevant literature highlighted areas that were examined using the "how" and "why" type questions. The guide was a compilation of the CLM team members' evaluations of questions that created informers. These questions were open ended enough to encourage the exchange of information. At the same time, the guide presented a path through a number of basic questions that needed to be asked to ensure a thorough understanding of each company's techniques.[97] In practice, this worked very well because it encouraged free discussion while ensuring all the necessary areas were covered.

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[95] Eisenhardt, op. cit., pp. 538 - 541.
[96] Yin, op. cit., pp. 51
[97] Novack, op. cit.

The questions were broad in nature with a few exceptions. There were requirements for some specific data on time, revenue, cost and service. These were included to provide additional data to support the comments of the open ended questions. The broad questions covered topics about value definition, quality, quantification and profitability. A copy of the guide is included in the Appendix B at the end of this work.

Data Analysis

Case study data did not offer simple, clear numerical data that could be tested by statistical methods. The rich interviews and observations provided the researcher with mountains of comments that had to be sorted, combined, categorized, and organized. The goal of the reorganization was to identify trends and reoccurring themes by comparing different case studies. The cross study comparison was the strength of the technique. Yin suggested the use of cross study comparison that would support basic analytical tools for examination.[98] He also included a diagram of the process that clarifies the process of collecting and analyzing the case study participants.[99] (See Figure III - 3)

Once a case study was complete, the process of data analysis could begin. First, the data was organized. Normally, this should included converting the raw comments into complete transcripts of all the conversations. However, the companies were unwilling to allow taping of the interviews due to the sensitive nature of much of the material. Therefore, the written notes were used to record major ideas and key quotes. Furthermore, the exhibits and support data provided by the company was included. The total data was retained, sorted and organized. However, much of this data was edited to

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[98] Yin, op. cit., pp. 97 - 101.
[99] Ibid., pp. 51.

remove the less useful information and comments. The remaining information provides the actual data for analysis.

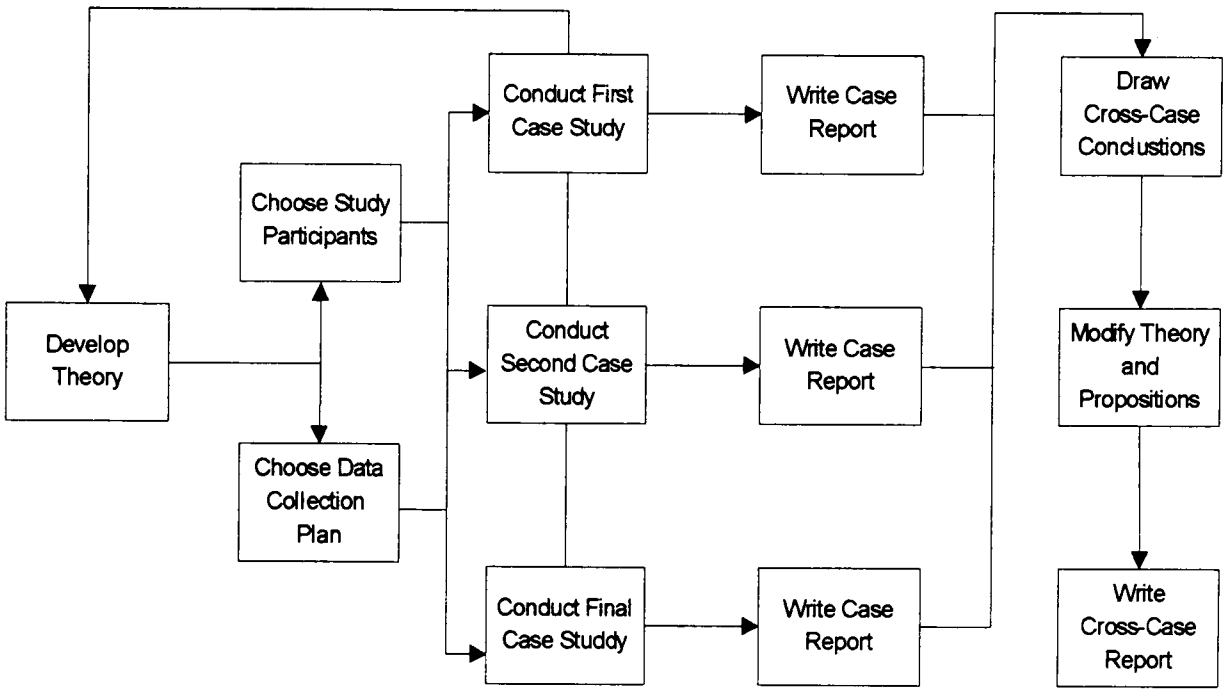


Figure III - 3
Case Study Analysis Process[100]

This is the point the CLM team and dissertation study split. The CLM study has completed an initial analysis of the case studies. The dissertation research will complete a more thorough analysis of the cases to write the dissertation case study results and to build the dissertation survey.

Therefore, the next step of the process will be the writing of the actual case study narratives. Each set of data will furnish the needed material for a complete write-up. The goal is to present a case report that represents the interviewee's ideas, concepts and methods. Each case write-up will focus on the areas that the propositions attempt to

[100] Ibid.

examine. These narratives allow the reader to capture the essence of the companies' ideas and comments without having to sort through lengthy transcripts. The material is further simplified by the inclusion of visual techniques to highlight key information. Miles and Huberman recommend using flow charts, matrices, counting, clustering, frequency tables, histograms, etc.[101]

The cross case study analysis occurs after all of the individual case studies are complete. Although many members of the CLM team wrote the initial case analyzes, this researcher will conduct the cross case analysis of all the different company cases as part of the dissertation research. The cross case study is based on Yin's model of qualitative research analysis as shown previously in Figure III - 3.[102] The methods employed by the various companies will be compared. Also, the methods will be used modify the CLM team's preliminary model of the value that logistics creates. The model was modified throughout the case study phase, but the cross study analysis will provide key insights to the industry's view of the logistical process of value creation.

The cross case study method will help to explain and understand ideas and concepts based on the pattern building. These ideas will be compared to the propositions of the case research to determine if the propositions have enough merit to continue as the basis for further research. The case study analysis may lead to the development of new and very different propositions that will guide future research.

The goal of this section is to clearly state the reason case studies were used, the strengths of case studies and the actual methodology steps that occured during the research. The exploratory nature of eariest part of the CLM phase supported the use of case studies. Numerous authors have supported this technique for similar situations.

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[101] Miles, Matthew B. and Huberman, A. Michael Qualitative Data Analysis (Beverly Hills, CA: SAGE Publications, 1984); pp. 215 -228.
[102] Yin, op. cit., pp. 51.

Finally, the company selection through analysis of the case studies method has been presented.

The sections that have not been addressed are the weaknesses of case studies and the propositions that will be used. The weakness of case study portion and survey phases will be addressed simultaneously later in this chapter. This is because the research is designed with two basic approaches of research to specifically address the limitations each method. The propositions are included in the next section.

Propositions

This section lays out the propositions that guided the study questions. These propositions attempt to present a framework that was used to develop a model of the value of logistics. This author developed all of these propositions independent of the CLM team. However, there is some overlap of the concepts for obvious reasons. The propositions are grouped into categories: definition, quantification, best practice and application.

The first major research question of the paper deals with value. Value and value-added are covered in the definition category. The definition of value and value-added are necessary to complete the remainder of the research. Each individual's and company's understanding of value is needed to understand and analyze the data. There are a number of propositions to examine this area.

P_1: Logistics managers can define value. Also, the managers will normally establish their definition as or within the company's definition of value.

This proposition attempts to examine the actual definition of value. Also, it addresses the point of who is creating that definition. Is value defined by the firm, the external environment or some combination of the two?

P_2: There is a difference between value (core competence) and value-added (competitive advantage). However, there are common definitions, themes and practices between leading edge companies.

Today's business world normally uses value and value-added interchangeably. This question attempts to remove the "buzz" word status and verify if the two are interchangeable. Also, the leading edge companies will have very similar definitions of value and value-added. This will include the daily usage as well as the formal company definition.

P_3: Companies that differentiate between logistics' value and cost perform differently than organizations that do not.

This proposition will compare the leading edge firms that differentiate the value from cost with another firm that does not. The expectation is that they will be more profitable than the non differentiation firms. A suitable time frame for the comparison is last the five years.

The remaining three categories deal with the second major research question of measurement. If the value can be defined, the next step is to identify the method or methods used to quantify. Questions will cover a number of areas to include customer service, profitability, return on investment, measurement methodology, strengths and weaknesses. A key finding would be a company's model for its logistics measurements of value and value-added services. A number of important propositions will guide the research.

P_{4a}: If a company identifies there is or are measures of logistics value then certain measures will be common between companies. (Return on investment or profitability should be the most recurring.)

P_{4b}: The companies that measure logistics value may use a number of measures that are combined to provide an overall measure than is broader than using just ROI or profitability.

Propositions 4a and 4b deal with each company's method of measurement. It examines if there is only one measure or is it a combination of measures. It also highlights the more common measures that many companies may be using with ROI and profits.

P_5: Companies attempt to quantify logistics value with customer service, quality or other substitutes.

Given the difficulty of measuring value directly, this proposition attempts to identify what attributes or substitutes companies are using for value. If a company can measure value directly, it will be extremely important. However, if all of the leading edge case study companies are using substitutes of some form, it will be as useful to identify and compare the different choices made by these organizations.

P_6: It is possible to measure customers' perceptions of logistics services which are often "invisible" to the user.

This is an important point for the companies to recognize. They must demonstrate that they closed the gaps between their perceptions and those of their customers. The measurement of value is meaningless if the company does not measure the item or service that adds value to the customer.

The third area of examination is the best practices currently in use at the leading edge firms. The researcher will perform a benchmark examination of the companies and their practices. This benchmarking of leading edge firms will help to identify if some of the quantitative measures identified in the previous section are providing better results or are more efficient.

P_7: Some case study companies will use practices of determining value that are better or more efficient than other companies that have had early quantification success.

Proposition 7 appears to be obvious. However, the obvious needs to be confirmed as well to allow the continuation of the overall study. This proposition is necessary to allow comparison of the companies using the other propositions in this section.

P_8: The companies that view logistics as a value compared to companies that identify it as only a cost will use more of the best practice types of measures and definitions of value.

This proposition compares the different types of companies and compares the practices that they use. The companies that take the time to formally define value should have developed better practices and methods of quantification. The more advanced companies in one area of value should be more advanced in the other areas of value.

P_9: Companies that measure the value of logistics have more financial success (profitability, market share, ROI) than companies that do not quantify.

Proposition 9 examines the idea that the companies that quantify the value of logistics have more financial success. This can be measured with a number of definitions of success. Again, the last five years can be used as a benchmark. As long as the researcher recognizes that a number of other contributing factors may be involved, the general idea of quantifying may be responsible for a part of a company's financial success.

P_{10}: There are specific measures of value that are indicators of long term success (survival and growth) for that company or division.

This is the most difficult of the best practices propositions to examine. This proposition is not critical to the overall success of the study. However, any information that could identify a best practice that leads to long term success would be especially useful. The best practice of different methods of quantification may be identified by the cross case study analysis of the leading edge companies.

The final section addresses the external validity or the applicability of the information found in the case studies. A concern of a case study approach is the lack of

external validity due to the limited number of cases normally performed. A goal of this research is to present useful information and a model that may be used by many companies. This fourth section of propositions attempts to identify the areas, techniques, and measures that companies can use to quantify their processes.

P_{11}: There will be common characteristics or factors that can be determined from benchmarking the best companies which would be useful to other companies attempting to quantify their logistics value.

The case studies should identify some recurring traits in the companies that are examined. These characteristics should help to identify useful information to other logistics divisions and firms that have similar characteristics. These factors can be confirmed by a mail study to increase generalizability throughout the field.

P_{12a}: There are some methods that can increase the external validity. Some methods have wider applicability than others.

P_{12b}: These methods may be combined to increase the overall external validity. Some methods will be used in combination more often than others.

These propositions examine the use of common methods by many companies. If the case analysis identifies that companies are using common practices (ROI, on time delivery, profitability) as part of their quantification process, the generalizability to other companies that use these techniques would be increased. However, proposition 12b implies that there may be numerous combinations and not a "best" solution for non case study companies. While there may not be a single, correct answer, there may be reoccurring techniques in the combinations.

P_{13}: Different parts of the transportation and logistics industries will need, develop or use measures that are unique to their needs.

Proposition 13 is similar to 12b. There will be different modes or logistical areas that the common methods or a "best" solution will not increase generalizability. Just as

there is no single, correct method, different modes or services may have unique requirements that reduce the applicability. The identification of these special modes or services will be useful to highlight opportunities for future research.

These four areas (definition, quantification, best practice, application) provide the framework for the dissertation study. Each area contributes to the research design. The results of these propositions will be a better understanding of the value determination process and its usefulness to the industry as a whole.

Mail Survey

The purpose of this section is to cover the rationale for selecting a mail survey as the instrument. There are inherent strengths and weaknesses that must be identified before choosing this method to collect data. The following sections will cover the actual data collection and analytical techniques.

Part of the CLM study and all of dissertation research attempts to broaden the findings of the CLM case studies. There are a number of options available to the CLM team and the dissertation researcher to accomplish this goal. However, many of these techniques would be impractical from a time or financial view (i.e., 1,500 in depth interviews, 1,500 telephone interviews, 500 additional case studies, 200 focus groups, etc.). Some of the practical considerations limited the choices for the both the CLM team and the dissertation researcher.

A mail survey provided a practical solution to many of these problems. However, convenience alone was not a substantial enough rationale to proceed. Additional support for the use of a mail survey was necessary.

Kerlinger stated that a survey is appropriate if the research goal is to make an "accurate assessment of the characteristics of whole populations of people."[103] Dillman also supported the use of mail and telephone surveys. He maintained the use of surveys was proper to examine geographically dispersed groups. Furthermore, he stated that surveys were useful to help generalize results from subcategories to other groups.[104] Finally, Sudman and Bradburn provided additional support. Their book about question and survey design supported the use of a survey with closed ended questions to capture numerical data on anything from attitudes to demographics.[105]

For the further collection of data, each of these authors provided support beyond mere practicality for the use of a survey. The case studies in CLM phase and the literature review clarified the types of questions that needed to be asked. The CLM survey was and the dissertation survey will be able to measure the attitudes of logistics professionals, the techniques in use, the demographics of their companies and other important concepts discovered in CLM case study phase. This dissertation survey will confirm or deny the early findings.

The use of a mail survey provides the researcher with the best opportunity to gather large amounts of data from many sources. The dissertation survey will be very useful in examining the findings of the CLM research. The selection of a mail over a telephone survey is to allow a broader number of questions and to reduce the overall cost. The dissertation mail survey will allow the broadest examination of concepts and techniques during the shortest period of time.

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[103] Kerlinger, op. cit., pp. 377 - 378.
[104] Dillman, op. cit., pp. 4 - 5.
[105] Sudman, op. cit., pp. 88 - 175.

Data Collection

The CLM data collection instrument was designed based on feedback from the early cross case studies. The initial case study format is included in the Appendix B and the CLM survey is included in Appendix C. The dissertation survey will be based on the results and completeness of the CLM survey and the results of the final cross case analysis. Also, specific areas of interest to this researcher that the CLM team did not include can be added to the dissertation survey. The dissertation survey is also included in the Appendix D. The remainder of this section will address the techniques of design, the sampling plan to select participants and the mailing plan to increase the response rate.

As stated earlier in the chapter, the survey will be designed based on the guidance of various authors. The Total Design Method (TDM) will guide this phase of the research from conception of the survey through the last follow mail reminder.[106] Most of the questions will be constructed to be closed-end response type questions to provide the numerical data for testing theories developed during the case studies. The second survey will further test concepts identified by the first survey from phase one.

The Council of Logistics Management provided a membership list of approximately 5,000 names. Each person record included demographic data: company, title, address, phone, responsibility, industry, etc. The list was edited by using the following procedure. First, the dissertation researcher removed any individual who did not have either title or company. Next, the researcher deleted all non United States and Canada members. The final step included the elimination of all duplicate entries from one company. The researcher only kept the highest title or level of responsibility for each company. This produced a total mailing list of just over 1,600 individuals each representing the highest level of logistics personnel in those companies.

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[106] Dillman, op. cit.

The first step was to conduct a pretest of the survey instrument. Approximately 15 individuals received the survey along with an accompanying letter describing it as a pretest of the eventual survey. This step was repeated as necessary based on the number of changes after each pretest. The next step was to mail each of the 1,600 companies a survey and cover letter based on the TDM and the pretests. The surveys were followed by the reminder post cards and letters to increase the response rate.[107]

The dissertation survey will follow the mechanics of the CLM survey. However, there are a number of significant differences. First, the survey used for the CLM study was designed by a team. The second survey will be designed by this author. Next, Penn State was responsible for the implementation of the aforementioned steps in the CLM survey. The management of the dissertation survey will be performed by this author at Tennessee. Finally, the number of surveys sent will be smaller and more directed. Only respondents to the CLM survey will be contacted to gather follow up type information as well as data to test concepts (approximately 400). The other steps will follow the same TDM design, pretest and mailing format, to ensure adequate response rate.

Data Analysis

At this point, the statistical methods to be used can be identified. The strength of the survey is the gathering of quantitative data that can be used to identify significant findings. Various techniques will be used to analyze the data.

Due to the surveys' design, the majority of the data collected by those instruments will be ordinal and independent. This allows the use of the basic statistical techniques from simple frequencies to general and multiple linear regression. Also, the analysis of

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[107] Dilliman, op. cit., pp. 119 - 191.

variance and covariance will be possible using ANOVA. Finally, some non parametric analysis may be performed based on responses to specific questions.

There is a problem of using the ordinal data as interval data to determine the importance or strength the respondents' views of certain items. The use of Likert scales will allow the research to better identify the levels of importance. The data will be normalized to help reduce bias in the appropriate sections. Cluster analysis will be applied to determine if there are relationships between certain logistical techniques and to confirm finding of the regression.

Due to the exploratory nature of the study, there should be no preconceived relationships between the variables. Therefore, the use of confirmatory factor analysis or LISREL is an inappropriate technique at this time. However, it presents an opportunity for future research.

The goal of the data analysis is to confirm or reject the research questions. The next section will provide the hypotheses that the data analysis will examine. The correct analysis techniques will add strength to the findings.

Research Hypotheses

The research hypotheses are derived from both the research questions and the case study propositions. The goal of the mail survey is to generalize the findings of the earlier research. Based on the propositions, the hypotheses provided the basis to design the dissertation questionnaire. This section presents the research questions with their relevant hypothesis. Also, the appropriate survey question that will collect the necessary data to determine the strength of the hypothesis is identified. Both the CLM and dissertation questionnaires are included in the Appendix.

The first three research questions deal with the definition of value. Each attempts to identify how logistics managers and their companies define the term related to value. Also, the objective is to compare various definitions.

Question #1: Do logistical organizations have a definition of value?

H_0: Companies do not report any definition of value.
H_1: Companies report definitions of value.

The first objective of the research is to identify the definition of value, value-added and logistics value. Although it is unrealistic to expect to find a single best definition, it is possible to determine if logistics managers and their companies have a definition of value. This question will be addressed in the dissertation survey by questions one and two.

These questions will be used to differentiate respondents as having a definition of value or not. That information will be used for analysis of later questions. This data will be initially analyzed using frequencies counts. Later, it will be used as the critical class variable for non parametric one way analysis of variance (Wilcoxon Rank Sum Test).

If the overwhelming response to the first question is no, then the following research questions lose some of their importance. However, it is reasonable to assume the companies are attempting to determine value. There is evidence that some companies are attempting to identify the value of logistics: the literature review identified some and early case study interviews highlighted attempts.

Question #2: Are there common themes between various companies?

H_0: There are not recurring terms or ideas in the definitions.

H_1: Managers and companies use similar terms and ideas in defining logistics' value.

This second question presents a research problem. The second question on the second survey asks the manager to provide the definition of value used at his company. This is an open ended, qualitative type question. A content analysis type approach must be used to determine if the respondents are in fact defining value in similar terms. However, it should be useful to determine common themes such as: cost, efficiency, profits, customer satisfaction, etc.

Question #3: Is there a difference between value and value-added?

H_0: There is not a difference between value or value-added.
H_1: Managers differentiate between value and value-added.

This question completes the definition section of the research. The goal is to determine if there is differentiation between the terms of value and value-added. This research question will be addressed by combining the survey questions one, two and three from the dissertation survey. The comparison of research question two's qualitative results can be compared to the results of the other survey questions.

The next set of questions focuses on companies' attempts to quantify logistics value. Again, this section is predicated on the belief that logisticians perceive value in their services. This section will focus on particular techniques, tools and methods used by firms.

Question #4: Do logistical organizations use similar measurement techniques to quantify the value of logistics?

H_0: Logistics organizations do not use the same measurement techniques.

H_1: There are measurement tools that many logistics firms use to quantify logistics value.

This research question will determine the common measurement techniques used by the sample to quantify value. There are a number of questions that provide data that will test this hypothesis (CLM survey question II-2 and dissertation survey questions six, eight and nine). The key point is to determine the level of use of the specific tools.

Question #5: Are companies measuring costs, attributes, consequences and/or values in their quantification methods?

H_0: Companies do not use costs, attributes, consequences or values to quantify the value of logistics.

H_1: Companies use costs to measure the value of logistics.

H_2: Companies use attributes to measure the value of logistics.

H_3: Companies use consequences to measure the value of logistics.

H_4: Companies use values to measure the value of logistics.

H_5: Companies use a combination to measure the value of logistics.

This research question attempts to identify the most common techniques in use. Also, the objective is to determine the combination of techniques that companies employ. Furthermore, it will rank the perceived importance of each choice. The same survey questions used to answer the last research question will be used to collect the necessary data (CLM survey II-2 and dissertation survey six and thirteen).

The second section dealt with the various techniques in use. The third portion builds on it by identifying the best practices of logistics value quantification. The research is dependent on the definitions of success or best. The second survey identifies companies

that view logistics as a competitive advantage or a profit center. These companies will form the basis for comparison as "leading edge" type companies.

Question #6a: Do companies that have success measuring the value of logistics also identify logistics as a profit center?

H_0: Companies that view logistics as a cost center have not had success quantifying the value of logistics.

H_1: Companies that view logistics as a profit center have had success quantifying the value of logistics.

Question #6b: Do companies that have success measuring the value of logistics also identify logistics as a competitive advantage?

H_0: Companies that view logistics as a core competency have not had success quantifying the value of logistics.

H_1: Companies that view logistics as a competitive advantage have had success quantifying the value of logistics.

Research questions 6a and b deal with the relationship between quantification success and other levels of success. The other levels of success may be considered productivity, utilization and financial improvements. The firms that have achieved some success quantifying will be considered the "leading edge" firms of the industry for comparison to other companies. Since there are numerous contributing factors to success, the study will have limited predictive power of success. Questions three through six on the dissertation survey will be compared to questions from parts two through four in the CLM survey. These variables will be compared using both the non parametric analysis and the chi-squared comparison.

Question #7: Is there a most prevalent method?

H_0: There is not a single prevalent technique in use.
H_1: One technique is used by a majority of industry respondents.

The goal of this research question is to identify if there is a single best or most used measurement technique. Realistically, this is not a logical assumption. However, it may be possible to identify a group of three to four techniques that companies prefer. This group may then be used as a basis of a normative model describing the quantification of value. This question will be analyzed using the CLM survey questions II-1, II-2 and the dissertation survey questions six, eight and nine.

Question #8: Are there common demographics among the companies that report success with the quantification of logistics?

H_0: There are not common demographics between sample companies.
H_1: There are common demographics between sample companies.

This research question's objective is to identify common traits between respondent companies. This will help to determine if any of the common traits either facilitate or improve the process of quantifying value. The CLM survey's Part V (demographics) can be used to compare to other responses using the Wilcoxon test to determine if any relationship exists between demographics and other areas.

The final research question deals with the genalizability. Although much of this section is covered by moving from the case studies to the questionnaires, there is the specific question that must be addressed by the dissertation. The final question deals with

the normative concepts of process and methodology. This area deals with the methodology that companies used to achieve some level of measurement of logistics value.

Question #9: Are the methods transferable between different companies?

H_0: There are not transferable methods that companies can exchange.
H_1: There are transferable methods that companies can exchange.

This is another "obvious" question. However, the goal of this question is to identify the process of adopting techniques to measure quantification. This will be useful to identify the normative model of the process. The data for this section comes from the dissertation questionnaire number thirteen.

This section converts the propositions from the case study examination into the research questions used to design the dissertation questionnaire. The questions are further divided into the four original areas of examination: definition, quantification, best practice and application. The research questions present the concepts for the dissertation's study.

Table III - 1
Research Propositions and Research Questions

Prop.	Question	Collection Method	Primary Analysis Technique(s)
P1	Q1	DS	Wilcoxon Rank Sum Test
P2	Q1, Q3	CS, CLMS, DS	Wilcoxon Rank Sum Test
P3	Q6ab	CLMS, DS	Wilcoxon, Chi Square
P4a	Q2, Q4	CS, CLMS, DS	Content Analysis, Chi Square
P4b	Q2, Q4	CS, CLMS, DS	Content Analysis, Chi Square
P5	Q5	CLMS, DS	Wilcoxon, Chi Square
P6	Q5	CLMS, DS	Wilcoxon, Chi Square
P7	Q8, Q9	CLMS, DS	Wilcoxon, Chi Square
P8	Q6ab	CLMS, DS	Wilcoxon, Chi Square
P9	Q8, Q9	CLMS, DS	Wilcoxon, Chi Square
P10	Q6ab	CLMS, DS	Wilcoxon, Chi Square
P11	Q8	CLMS, DS	Wilcoxon, Chi Square
P12a	Q7	CLMS, DS	Weighted Rankings, Wilcoxon
P12b	Q7	CLMS, DS	Weighted Rankings, Wilcoxon
P13	Q7, Q8	CLMS, DS	Weighted Rankings, Wilcoxon

A major goal of this methodology is to ensure that each proposition is further studied by a related research question. For clarity, Table III - 1 presents the relationship between propositions and their corresponding research questions. Table III - 1 presents each proposition, the corresponding research question, the data collection instrument and the analysis technique. Due to the exploratory nature of the research, some additional findings may occur. However, the primary propositions are addressed by the specific research questions.

Research Design Strengths and Limitations

The major strength of the study is the thoroughness of the total research design by combining the results of the two very different phases. The in-depth case studies should provide the deep understanding of the "how" and "why" type questions. The mail surveys then build on the lessons of the case study phase. The integration of the two approaches highlights the best of each method while minimizing the limitations of both. Wallendorf and Belk call this "triangulation."[108] The overall effect is a stronger research design. The major problem of case studies, lack of generalizability, is addressed by the scope and design of a mail survey. The weakness of the mail study, lack of data richness, is covered in the case studies. The research is designed to gain synergy from the two methods.

As positive as the previous statement sounds, there are limitations to the research. First is the case studies provide the foundation for the entire work. If the case studies are

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[108] Wallendorf, Melanie and Belk, Russell, "Assessing Trustworthiness in Natural Consumer Research," Interpretive Consumer Research, Assn. for Consumer Research, 1989, pp. 69 - 82.

not representative of leading edge firms, then dissertation phase may not have value. There is still the possibility that the sample of ten firms is not representative.

The second major issue is the use of the CLM database. This group of individuals is not necessarily representative of logisticians as a whole. Also, it is an over used population to provide mailing lists. The members may become overly influenced or apathetic by the large number of surveys they receive.

The overall strengths of the research design far out weigh the disadvantages. This is the reason this method will be used. As long as the limitations are recognized and accounted for, the problems that they cause may be minimized.

Conclusions

This chapter is designed to present the methodology of the study. It discusses the research plan, objectives and methods. The details of case studies, propositions and surveys are included to identify the techniques that will be used to successfully conclude the research. Each of the sections covers the methodology that the research design will address.

The overall plan of a two phase design appears to present the most thorough method. It maximizes the strengths and minimizes the weaknesses of the individual methods. Additionally, it is practical enough to be accomplished within a reasonable time limit. Although no plan is perfect, this design should meet the objectives of better understanding and describing the value of logistics.

Chapter IV - Case Study Results

Introduction

One of the primary goals of the CLM study was identifying various companies' definitions of value and value-added. Furthermore, the case study participants provided "real-world" validation of various quantification techniques. The case studies further highlight the important characteristics identified by the companies.

This chapter discusses the results of the case study research. The focus is on the four companies for which this author helped to conduct the case study. Appendix E provides the company profiles of these four companies. The remaining six case study companies results are not discussed in detail in this chapter. Their information is only included to support general findings and trends of all the case study companies. One page overviews are included for the remaining six case companies in Appendix F.[109]

The primary purpose of this chapter is to compare the propositions from Chapter III to the results of the case studies. The chapter is divided into four sections. The first is this brief introduction. Second, a short review of the case study process is presented. Third, each proposition and the research findings are discussed. Next, the chapter

[109] Novack, Robert A., Langley, Jr., C. John and Rinehart, Lloyd M. Creating Logistics Value, Themes for the Future, (Chicago, IL: Council of Logistics Management, 1995); pp. 215 - 227.

includes a section on findings beyond the propositions. Finally, the overall findings are reviewed and the conclusions from this phase of the research are presented.

Case Study Mechanics

Before the arrival of the CLM team, the case study company received a copy of the case study guide and the concurrent CLM survey. This was to help the interviewees understand what information the CLM team would try to collect. This assisted the case study companies to identify the appropriate individuals for interviews as well as collect relevant support material and data. Each case study was conducted based on the case study guide provided in Appendix B.

As Chapter III discussed, the case study notes were analyzed one company at a time. The author completed an in-depth analysis of the four companies in which he participated in the data collection. After each company was completed, the findings were consolidated and analyzed. These companies provide the examples throughout the remainder of this chapter.

The use of only four case study companies could have presented a problem. However, the other six companies results were included in the overall evaluation of the results. The combined total of ten case studies provide adequate data to examine the propositions.

Propositions

P_1: Logistics managers can define value. Also, the managers will normally establish their definition as or within the company's definition of value.

This proposition provided an interesting set of responses. First, the case study companies were all considered "leading edge" type logistics firms.[110] However, none of the case study companies had a clear, written definition of value. Many of the managers interviewed felt they had an understanding of what logistics value was, but found it difficult to verbalize.

One of the benefits of the case study process was that it helped the managers to consider the question of value and its definition. They used the preparation material sent to them (survey and case study guideline) to help examine their companies' and their personal definitions. The managers then began a process of trying to identify what is "value" and how it may be created by logistics. Often, the managers would attempt to use a company mission statement or objectives to frame their personal definition of value.

Various levels of executives provided their definitions. Although they often found it difficult to express a clear, concise definition, many of the quotations described the traditional value concepts of time and place utility. However, some of the comments moved beyond the traditional approaches and viewed logistics in broader terms.

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[110] Bowersox, Donald J., Patricia J. Daugherty, Cornelia L. Droge, Dale S. Rogers, and Daniel L. Wardlow, Leading Edge Logistics, Competitive Positioning for the 1990's, (Chicago, IL: Council of Logistics Management, 1989).

- Value is reliability of being able to deliver, (and) is a key at 98 to 99% of the time.[111]

- Value must be described in the eyes of the corporate divisions because they are funding some of the changes.[112]

- Value is the definition of what the service brings to folks in the supply chain that we are not doing today.[113]

- The CEO knows (logistics) adds a lot of value, but is unsure how to recognize. Although the recognition is growing rapidly.[114]

- It is how you leverage what we're doing with distribution to get value for the customers.[115]

Other comments focused on the opposite side of value: cost. Many of the interviewees discussed value from the cost approach. While they found it difficult to talk about value, the costs of logistics highlighted the importance of the function. At the same time, it was generally recognized that containing and reducing costs was an integral part of value.

- The lack of awareness of logistics was that no one recognized the cost or time of the logistics process (time utility and cost).[116]

- Logistic was a large cost to the company. Also, we don't forward to the warehouse because it would cost money.[117]

- We compare the cost of additional machinery against the upgrade shipping based on delays from the previous Christmas.[118]

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[111] L. L. Bean
[112] Nicholas J. LaHowchic - Becton Dickinson
[113] Ibid.
[114] L. L. Bean
[115] Henry B. Smith - Becton Dickinson
[116] Kelvin Phillips - National Semiconductor
[117] Ed Shoester - Welch's
[118] L. L. Bean

Each of the previous quotations displays an understanding of the value of logistics without a clear definition. The speakers all focused on cost as part of a problem. The problems all included the concepts of creating value to the customer, company or shareholders. The reduction of logistics costs was seen as adding value by the case study companies as long as levels of service were either maintained or improved at the same time. This apparent contradiction of less capital and greater service appeared as a reoccurring theme throughout the case study research on value.

The case study findings did not affirm Proposition #1. Managers were unable to clearly define value. However, they did have a working "feel" for the topic. This feeling was often part of the company's view. Welch's had a "thrifty" company policy that translated to a cost conscience approach to logistics. L. L. Bean's approach to total customer satisfaction focused logistics on extremely high levels of logistics service from their company.

P_2: There is a difference between value (core competence) and value-added (competitive advantage). However, there are common definitions, themes and practices between leading edge companies.

Just as there was difficulty defining value, the logistics executives failed to provide a clear and concise definition of value-added. However, the concept of value-added was continuously mentioned throughout the case studies. Each logistics section attempted to be a value-added service to the company.

- Value-add [sic] (is something that) makes more money for the customer.[119]
- L. L. Bean doesn't believe that shipping accuracy gains competitive advantage, now (it is) a competitive competency.[120]
- The (logistics) function must continue to evolve because standard stock (and functions) no longer are value-added services.[121]

The main point of the managers was there was a working understanding of the difference between value and value-added. It mirrored the differences between core competence and competitive advantage. The value item or functions appeared to be necessities to maintain business. The case study results implied that the value-added services were the "cutting-edge" type processes that gained new business. All recognized that over time, those value-added, competitive advantage areas became more common value or core competence tasks.

An important point was that Becton Dickinson deliberately broke their customers into three categories and provided different levels of value and value-added services. They recognized their limited resources and allocated the highest levels of logistics service to their best customers. Only the top customers received the full package of value-added services. The remaining customers received all the basic core competence type functions and some of the value-added depending on their two companies' relationship with the supplier.

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[119] Dee Biggs - Welch's
[120] L. L. Bean
[121] Nicholas J. LaHowchic - Becton Dickinson

Proposition Two was much like the first proposition. There was not a formal definition or difference between value and value-added. There was a very clear understanding of the differences between the two. Furthermore, the managers recognized the different requirements to implement value and value-added activities. Finally, the companies had many of the same concepts and understandings of the definitions, understandings and implementations of the concepts.

P_3: Companies that differentiate between logistics' value and cost perform differently than organizations that do not.

This proposition was difficult to evaluate. The first problem was that none of the case study companies clearly differentiated between value and cost. The companies seemed to view value and cost on a continuum rather than as opposites. Therefore, it was inappropriate to make decisions about this proposition. This identified an opportunity for the dissertation survey to research more carefully.

In general, it did not appear that there were any major differences between the way the case study companies performed their logistics operations. There were some differences, but the basic concepts were similar. This may be misleading since all of the case study companies were attempting to quantify value. This implies that these companies had tendencies towards the value rather than the cost approach. However, they also identified cost as an important component of the process.

- Part of the quality effort was to measure the cost of mistakes and it is a tracked on a weekly basis: mostly re-work costs.[122]

[122] L. L. Bean

- Accounting is trying to create a financial model (of logistics).[123]
- Trying to put a dollar amount on the value of these services.[124]

The key point of this proposition may be a negative finding of the underlying assumption. It was not apparent that companies differentiated between value and cost. The case study companies view both cost and value as pieces to the overall process to satisfy customers' needs. The case study participants performed similar functions to meet those customers' requirements. The inclusion of quality processes (TQM) and accounting methods (early ABC) were common throughout the companies. The major consideration to this proposition was that none of the companies clearly differentiated between cost and value.

P_{4a}: If a company identifies there is or are measures of logistics value then certain measures will be common between companies. (Return on investment or profitability should be the most recurring.)

P_{4b}: The companies that measure logistics value may use a number of measures that are combined to provide an overall measure than is broader than using just ROI or profitability.

The case study companies were all working on methods to identify measures of logistics. There were common trends between the participants. Just as they performed very similar operations, the respondents were using similar measurement techniques.

- (We) do it based on a break-even for now ... part of the Yankee 'thrifty' tradition.[125]

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[123] Naz Bhimji - Becton Dickinson
[124] Ibid.
[125] L. L. Bean

- Break-even is our key measure.[126]
- Logistics is able to show bottom line profits. However, it may get lost in the finance department.[127]
- Welch's did it without any real economic evaluation.[128]
- It may eventually break-even, but that is not as important as the time sensitivity.[129]
- Did EOQ and used ABC margins ... found negative margins.[130]

The quotations highlight some of the common themes. The companies appeared to use very simple financial tools to evaluate their logistics systems. First, a break-even analysis was used by three of the four companies to determine the practicality of making logistics and other investments. Next, all of the case study companies discussed using ABC accounting methods. However, most were still in the formative stages of applying ABC. Finally, all used traditional productivity measures of logistics: cycle time, fill rates, on-time delivery, etc. These common measures were being further developed to help identify if customers' needs were being met.

Proposition Four identified that there were a number of common measures that transcended the case study companies. However, these measures appeared to be rudimentary at best. Although most companies included an accountant within the logistics

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[126] Larry Stroud - National Semiconductor
[127] Edmund Schuster - Welch's
[128] Ibid.
[129] Larry Stroud - National Semiconductor
[130] Ibid.

group, the use of ABC and even Return on Investment was limited. The surprise was the attempt to use performance measures by quantifying the increase or loss in business due to changes in levels of service. This was a step towards satisfying customers' needs while measuring the financial impact of those logistics services.

P_5: Companies attempt to quantify logistics value with customer service, quality or other substitutes.

As Proposition Four began to identify, Proposition Five focused on the possible substitutes for value: quality and customer service. The literature review identified these as reoccurring substitutes in previous studies. The case study companies reaffirmed this with many of their comments.

- Value is the quality of service and price of service. We improve costs by driving in quality.[131]
- Our Customer Satisfaction (Dept.) does anything to solve a problem if a customer or broker calls.[132]
- (We) created a TQM type measurement process of the logistics areas.[133]

All of the companies used substitutes for logistics value. The most common were quality and customer service. The case study participants discussed the benefits of improving their quality. These benefits included improved customer satisfaction and reduced costs. The companies discussed how quality services were moving from competitive advantages to requirements to meet their customers' needs.

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[131] Henry B. Smith, III - Becton Dickinson
[132] Edmund Schuster - Welch's
[133] Larry Stroud - National Semiconductor

Customer service was another substitute that was often discussed. The case study participants view customer service as a key component of their success. One of the best examples was the tee-shirts that L. L. Bean pickers wore. The front stated that "99.98% was all right if..." On the back it said, "you're willing to have 11,916 disappointed customers." This extreme example highlights the important role that customer service holds within these companies.

A final substitute was identified by some of the case study companies. The relationship that logistics formed with other companies and customers was viewed as a value. This partnership type mentality created value for both members of the relationship. Often, the logistics executives would discuss the benefits of creating long-term relationships with their customers. This value was another area that was not easily quantified.

Proposition Five was validated by the case study companies. All of the companies used some form of substitute for logistics value. In most cases, the substitutes were customer service and quality. Relationships or partnerships were less common substitutes that some companies viewed as part of logistics value.

P_6: It is possible to measure customers' perceptions of logistics services which are often "invisible" to the user.

One of the Service Quality Model gaps is the difference between perceived service and service delivery. This proposition attempts to determine how the case study

companies measure the services that their customers do not view. Some of the companies identified areas that they have had success measuring.

Welch's presented an example of an invisible service to the end-user that created measurable logistics value. Welch's managers identified the returns from preparing end of aisles grocery store displays (Display Ready Pallets). This was a value-added service that the grocery store received the benefits of the service at the check out counter. All of the logistical services were hidden from the end-user and most were hidden from the grocery retailer. However, Welch's also identified that the customers became more concerned with logistics. The customers were requiring Welch's to share more logistics information which increased the visibility of the logistics process.

- We can have an accurate measure of increased sales from Display Ready Pallets.[134]
- The buyers are becoming much better at tracking Welch's.[135]

L. L. Bean identified similar success identifying hidden value. They were able to measure the value of faster service to the end customer. Although the transit time was visible to the customer, the value in reduced returns was overlooked by the customer. L. L. Bean was able to calculate the increased revenue and reduced cost of fast service.

- Higher level of customer service results in the customer being more likely to keep the item.[136]

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[134] Dee Biggs - Welch's
[135] Edmund Schuster - Welch's
[136] L. L. Bean

These companies demonstrated the possibilities of measuring the areas that are not visible to customers. These services help to close the perceived service and the actual service gap. Regardless of the success of measuring this area, the companies providing the logistics service were working to increase customer service and profits. The companies that had success measuring "hidden" service identified the benefit of these activities. In most cases, once the benefits were achieved the companies searched for other opportunities that would improve service and increase profits.

Proposition Six was verified by some of the case study companies. All of the companies had success quantifying measures. Two of the companies successfully measured activities not visible to customers. These provided opportunities for companies to educate customers on additional services and close perception gaps. Regardless if the service was visible, the increased attention identified by Welch's appeared to be a common occurrence. If the trend of closer relationships continues, the increased requirements to share information may make this proposition unnecessary in the near future.

P_7: Some case study companies will use practices of determining value that are better or more efficient than other companies that have had early quantification success.

Proposition Seven reaffirms the obvious. It is important to ensure that the case study companies have different levels of success. This provided the necessary data to continue the study.

Most of the key differences involved the choice of technique. All of the case study companies were making progress. However, the companies not only used different tools, but also measured different areas.

Some of the basic techniques involved simple break-even analysis. While other companies employed a more advanced use of pay back periods involving the cost of capital. Another example came from the accounting methods. While all the case study companies felt that ABC was important, only one had attempted to apply it to the measuring of logistics functions.

The final example of differences came from the techniques used to collect information. The case study companies used interviews, surveys and traditional measurements to gather the necessary information. The use of these various collection methods influenced the choice of analytical tools used. The company that conducted interviews chose to apply ABC to quantify savings throughout other areas of the company.

As expected, the proposition was verified. The case study companies had various levels of success quantifying different areas. Each company appeared to have greater success in a specific area when compared to other case study companies. Certain measures had more success than others when based on the needs of the specific company. Each of the companies provided a good example of the use of a single technique.

P_8: The companies that view logistics as a value compared to companies that identify it as only a cost will use more of the best practice types of measures and definitions of value.

Proposition Three had trouble differentiating between companies' performance based on how companies viewed logistics value. Proposition Eight faced similar problems due to the fact that all of the case study companies had identified logistics as a value creating activity. However, the case study companies were at various levels of implementation of quantification processes. Also, the case study companies were able to provide information on some of their competitors for comparison.

As Proposition Seven identified, the case study companies were using some more advanced techniques to measure value. The example of the Display Ready Pallets by Welch's was stated as being unique to their company. Welch's competitors did not provide the service. Therefore, the competitor did not measure this value producing activity.

Other companies were employing other types of measures that their competitors had not implemented. A common example was measurements provided by outsourcing services from a logistics or transportation company. Two of the case study companies employed Federal Express to act as a third party logistics partner.

- So a good measure of it is if I outsource to FedEx, how do I quantify those savings?(sic) I may eventually catch up (break even).[137]

- Clearly, yes. We're able to measure additional service from the use of FedEx. We tested for two years to prove that additional revenue more than outweighed the costs.[138]

[137] Larry Stroud - National Semiconductor
[138] L. L. Bean

Proposition Eight was somewhat difficult to prove. There is adequate anecdotal evidence to suggest that it is true. Considering the positive findings, this presented an opportunity for the dissertation survey. This area is covered in greater detail in the dissertation results chapter.

P_9: Companies that measure the value of logistics have more financial success (profitability, market share, ROI) than companies that do not quantify.

This proposition was neither confirmed nor rejected by the case studies. The sample of case study companies biased the data. All of the case study companies were already leaders in their industries. It was not clear if any measurement techniques were directly responsible for those successes.

However, there was some support for Proposition Nine. The case study companies stated that the measurements helped to manage their operations and identify competitive advantages over their competition. This implied that the measurements contributed to the overall success of the case study companies. Since the data were both limited and biased, it precluded the drawing of any conclusions.

P_{10}: There are specific measures of value that are indicators of long term success (survival and growth) for that company or division.

All of the companies identified a number of measures that they indicated predicted financial success. The most common were the break-even and return on investment measures discussed previously (Propositions 4a and 4b). The companies all dealt with the

issue of reducing costs as well. These examples were the basis of long term financial success by tracking investments while reducing costs.

Furthermore, some of the companies had progressed to more advanced measures. Becton Dickinson provided a good example with their measures of not only the costs of different levels of service, but the estimates of the additional revenue generated. Welch's calculation of the end of aisle displays also supported the additional return for value-added services. These both identified benefits of making long term investments in various services to gain improved relations with the customer as well as additional profits.

However, this proposition suffers from the same problem as Proposition Nine. All the case study companies selected were successful. It was not clear if their financial success was due to the measurement techniques used. There is not a clear relationship between the long term success of the case study companies and their logistics measurement methodologies.

P_{11}: There will be common characteristics or factors that can be determined from benchmarking the best companies which would be useful to other companies attempting to quantify their logistics value.

By comparing the case study companies, there were a number of shared or common characteristics. The case study companies represented various different industries. Despite these differences, this author identified six major, reoccurring themes. There were numerous other similarities between the companies. However it would not significantly add to this work to discuss all of the similarities.

The first major common trait was the use of cross functional teams. All of the case study companies used some type of team approach. One of the best examples was the team approach of Becton Dickinson. They created a team that included marketing, management information systems and logistics personnel. Furthermore, the head of the "Supply Chain Management" divisional was a marketing individual. The other companies had similar organizational formats that supported cross functional teams.

The second common characteristic was the obvious attempt to develop measures. All of the case study companies were in the process of actively developing measurement systems. This finding was not surprising due to the selection of the companies. Each of the case study companies was chosen because of their initial success in developing quantification procedures.

Another common trait was the case studies companies situation. Each company was a leader within their specific industry. Again, this cannot be directly attributed to the use of logistics measures. However, the companies attempted to identify alternatives to "business as usual." These companies aggressively searched for new methods to improve logistics services. Along a similar track, they attempted to develop new logistics measures to evaluate logistics functions. L. L. Bean is a good example of attempting to identify another logistics improvement to maintain their leadership in the mail order business.

The previous trait is reinforced by these companies' view of logistics. The case study participants identified logistics as a source of competitive advantage. Again, L. L. Bean served as an excellent example because their primary function is to act as a

distribution center. However, Welch's, National Semiconductor and Becton Dickinson all recognized the advantages of applying logistical improvements to gain competitive advantage. A simple example was the identification of the unnecessary packaging on certain medical items added unnecessary cost to the channel. Becton Dickinson was able to improve its price to customers by first asking what customers valued, and then implementing the logistics improvement.

The final common characteristic was most of the case study companies were able to identify a single individual who acted as a supporter of the logistics process. These "champions" had various job titles from the CEO to a logistics manager. However, each worked to advance recognition of the value of logistics in the company.

These six common characteristics occurred throughout the case study companies. These traits added to the success of these companies. Each appears to be transferable to additional companies. The reoccurrence of the six major and many minor traits supports the validity of Proposition Eleven.

P_{12a}: There are some methods that can increase the external validity. Some methods have wider applicability than others.

P_{12b}: These methods may be combined to increase the overall external validity. Some methods will be used in combination more often than others.

Propositions 12a and 12b focus primarily on the most popular techniques in use. Furthermore, these propositions examine if the measurement tools are used individually or

in combination with other tools. The case study companies presented evidence that supported both portions of the proposition.

There appeared to be two broad categories of measure used by the case study participants. The first group dealt with some traditional logistics measure. Areas such as fill rates, inventory turns and cycle time were measured by a number of companies.

- A fill rate of 99.3% is too high and creates too much inventory ... that doesn't cover slotting allowances.[139]
- Fill rate and cycle time are used as (an internal) tool to find the service drivers of the individual distribution center.[140]

These quantitative measures focused more on the operational aspects of logistics rather than examining the value aspects. However, many of these measures were used in conjunction with cost measurement to form a foundation for analysis.

The second category of measurement dealt with cost. The companies used a number of common measurement tools and advanced techniques.

- We did EOQ (economic order quantity) and used ABC (activity based costing) margin ... and found negative margin on low value orders.[141]
- ABC is just now being adopted, but we are unsure of what areas need to be measured and what are our drivers.[142]
- (L. L. Bean) is able to identify the cost of (logistics) projects.[143]

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[139] Edmund Schuster - Welch's
[140] Nicholas J. LaHowchic - Becton Dickinson
[141] Kelvin Phillips - National Semiconductor
[142] L. L. Bean
[143] Ibid.

Other common cost measures included inventory value, quick or continuous replenishment costs, and logistics labor costs. However, the two most common measures were break even analysis and return on investment. These two measures were discussed in earlier propositions.

Proposition 12a dealt with the external validity and amount of use of various measurement tools. Clearly a number of methods occurred in most or all of the case study companies. The reoccurring nature of many measures provided support to Proposition 12a.

Proposition 12b examined the combinations used by the case study companies. Each of the case study companies combined some of the operational measures with at least one of the break even cost measures. Also, all of the companies either used or were implementing some form of ABC accounting to their logistics services.

Proposition 12a and 12b were confirmed by the responses of the case study companies. The most common techniques used were transferable between the different respondents regardless of their industry. The combination of cost and operational measures provide a starting point to quantifying the value of logistics to these companies. This was futher confirmed by the remaining six case study companies. Based on the ten studies, the external validity was high with these techniques.

P_{13}: Different parts of the transportation and logistics industries will need, develop or use measures that are unique to their needs.

The case study companies represented five different industries (Appendix A). Each of the participants identified unique measures used by their company due to the industry requirements. Some of the specific examples highlight this point.

Welch's designed a measure that incorporated slotting allowances.[144] Becton Dickinson created a measure to include rebates to their channel members.[145] National Semiconductor included the benefits of duty suspension in Europe due to the implementation of the EC '92.[146]

The companies verified the basis of Proposition Thirteen. Each identified various measures to meet the specific needs of their industries. It was not clear whether these techniques were transferable to other companies. Considering Proposition 12a, it would be reasonable to assume that the companies' unique measures are generalizable to other companies within the same industry. However, this may not be true between industries.

Additional findings

The case study companies provided a number of additional points. Although not addressed formally in the propositions, they added to the quantification process of the companies. There were two major points that contributed to measuring logistics value.

The first was the increased use of outsourcing. Two of the companies employed Federal Express Business Logistics Systems (BLS) to provide logistic support. In these

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[144] Edmund W. Schuster - Welch's
[145] Henry B. Smith, III - Becton Dickinson
[146] Larry Stroud - National Semiconductor

cases, BLS competed with other third party logistics companies. These companies helped the case study companies quantify some of the value of logistics throughout the selection process. BLS's Logistic Financial Impact Workbook is included in Appendix G. This example represents the quantification process that BLS provided to two of the case study companies. The selection process advanced the case study companies' understanding of both their logistics systems and the quantification process.

The other key finding was the organization of the case study companies. As previously identified, the participants applied cross functional teams to help develop measurement systems. However, the organizational structures all included a dedicated logistics department or division. These companies' structures not only recognized the importance of a logistics section but also maintained flexibility through the use of the team approach. The case study companies' logistics measurement benefited from this combination of a formalized organizational structure and a flexible matrix team type approach.

Conclusions

As stated in the introduction, there were various research goals of the case study phase of this investigation. The propositions identified definitions and various concepts concerning the level of quantification within industry. Many of the propositions were confirmed by the case study companies. However, there are a number of caveats. First, the small number of case study companies limits the validity of findings. Also, not all of

the propositions were confirmed or denied. This researcher failed to gather enough data to answer the questions raised by the propositions. Table IV-1 provides a brief review of the success of the research to determine the state of the logistics quantification of value. The table restates each proposition along with whether there was a positive or negative finding. Also, the strength of the relationship is based on number of case study companies responses to the proposition.

Table IV-1
Summary of Propositions' Findings

Proposition	Concept	Finding	Strength
P_1	Manager define value	Negative	Medium
P_2	Difference between value and value-added	Negative	Medium
P_3	Value vs. Value-added differences	None	NA
P_{4a}	Common measures	Positive	Strong
P_{4b}	Number of measures	Positive	Strong
P_5	Use of Value Substitutes	Positive	Strong
P_6	Measure "Invisible" Services	Positive	Weak
P_7	Use of more efficient measures	Positive	Strong
P_8	Value vs. Cost companies	Positive	Weak
P_9	Value measures lead to financial success	None	NA
P_{10}	Long-term success measures	Positive	Medium
P_{11}	Common characteristics	Positive	Strong
P_{12a}	Individual tools create external validity	Positive	Strong
P_{12b}	Collection of tools create external validity	Positive	Medium
P_{13}	Unique industry measures	Positive	Strong

There were a number of general findings from the case study research. The verification or denial of most of the propositions highlights the benefits of performing the case studies. These findings provided the basis of the survey research. The overall results of this section provide useful information to logistics managers and academics attempting to understand the value of logistics.

The findings point to a number of base-line conclusions. The first is that currently logistics companies do not have a clear understanding or definition of logistics value. In every case study, the individual felt he had an idea of the value of logistics. However, none of the companies had a formal, written definition. Each individual was left to his own concept. Furthermore, most of these people did not have a clear, concise definition.

This was further amplified by the failure to clearly differentiate between "value" and "value-added." All of the participants used these two terms interchangeably throughout the interviews. However, there was some differentiation based on value as a core competency and value-added as competitive advantage services. Without this clear differentiation, it was not possible to analyze if companies operated differently based on those definitions.

The second major group of findings dealt with the level and types of measures used by the companies to quantify value. The case study companies were considered fairly advanced logistics firms. However, the level of quantification was fairly low. Most of the case study companies focused on the cost side of logistics. Numerous comments

identified that the issue of quantification was not important until someone within the company recognized that millions of dollars were being spent on logistics.

Based on the cost focus, it was not surprising that the companies used various measures of cost. The most common was a break-even analysis using the initial cost of the logistics service compared to the projected returns. The case study companies attempted to decide if the project would add enough value (profit) to justify the investment based on a break-even period of a certain number of years. This process was further advanced in a case that applied a return on investment (ROI) type analysis. One company attempted to include the cost of capital and risk by setting a hurdle rate within their calculations. However, this measure was still not widely accepted.

Another measurement point was the common usage of various quantification tools. The reoccurring use of break-even analysis was highlighted. However, a number of other measures appeared to be used by the case study companies. All of the companies tracked the traditional operational logistics measures such as cycle time, fill rates, on-time delivery. The major problem was that they were unable to use the operational measurements to justify the value of logistics.

This difficulty of applying operational measures to value did lead to the use of substitutes. Each of the case study companies discussed quality and customer service. All of them stated that the use of operational measures resulted in improved quality and higher levels of customer service. Again, the trouble was the transition from these qualitative perceptions to quantitative measures.

This perception identified another point. Although each company began its measurement based on a cost measurement system, the companies believed that the logistics area was more important that just cost. The companies identified logistics as an opportunity to gain competitive advantage. Furthermore, most of the participants treated their logistics operations as profit centers. Unfortunately, the case study companies were not good examples of firms that perceived logistics as a cost center. This precluded the comparison between companies that treat logistics as an area of competitive advantage and companies that treated logistics as just a cost to the company. However, the dissertation survey analyzed this point. Those findings are presented in the next chapter.

The propositions found that the companies believed that the measurement process contributed to their overall success. Most of the financial measures confirmed this concept. The primary concern was the strength of that finding. It is unlikely that identifying and measuring the value of logistics was the driving force behind the case study companies' success. The main point is that the quantification process not only contributed to that success, but allowed managers to make predictions using some of the measurement techniques.

The last major finding of the propositions was the generalizabilty of the tools. Most of the measures were used by companies in very different industries. The basic measures were transferable between the case study companies. Also, most companies used a very similar collection of operational and financial measures. Finally, there were

certain measures that were developed to meet industry specific needs. The ability to transfer these unique measures between companies within an industry was not observed.

There were a number of critical points that were identified that had not been specifically covered in the propositions. Due to the exploratory nature of the research, it was not surprising that a number of new points came from the interviews. These findings highlighted important areas for further research in the dissertation survey.

The first of these additional findings was that each of the case study companies had an internal "champion" of logistics. This person not only recognized logistics as an opportunity to gain competitive advantage, but also acted as the driving force to create a process of logistics improvement. This individual varied from a CEO to a logistics manager. Regardless of his job title, he worked to promote logistics within the company. Also, he demanded the logistics operations continuously improve. This led to the beginning of the quantification process in some of the companies.

Another finding was the increased use of outsorcing. Two of the four case study companies were outsourcing major portions of their logistics operations. The process of selecting the third party provider helped to quantify the case study companies' process. The third party firm provided its own quantification. Also, the selection process helped the case study company improve its internal measurement process.

Finally, an important point was the companies' organization structure. These leading edge firms created cross functional teams. The teams would analyze the logistics

process to evaluate the logistics process and possible opportunities. The companies employed a traditional logistics structure as well as a matrix structure for special projects.

Chapter V - Survey Results

Introduction

As the Methodology chapter outlined, this dissertation included two separate surveys. The first was conducted jointly by Pennsylvania State University, Michigan State University and the University of Tennessee. Results of the first survey are covered in detail in *Creating Logistics Value, Themes for the Future*.[147] Therefore, the details of that research shall not be repeated within this work. Only a few new statistical tests of that data are included for specific research questions identified by this dissertation.

The second survey was the dissertation survey. The goal was to further develop ideas and to examine new areas not fully addressed by the first survey. The results of this dissertation survey serve as the basis for this chapter and will be covered thoroughly throughout it. (Note: unless stated otherwise, all comments, points, etc. are from the dissertation survey.)

The majority of the chapter is spent attempting to answer the hypotheses developed in Chapter III. After this introduction section, there is a respondents' demographic section. Next, this chapter will present each research hypothesis along with the relevant findings. The fourth section will present additional findings of the surveys. Finally, the chapter will end with conclusions.

Respondents' Demographics

As identified in Chapter III, the survey was sent to members of the Council of Logistics Management. Although this sample is partially a sample of convenience, based

[147] Novack, Robert A., C. John Langley, Jr. and Lloyd M. Rinehart, Creating Logistics Value, Themes for the Future, (Chicago, IL: Council of Logistics Management, 1995).

on the demographics of the respondents, they appear to be a representative group. The respondents were from various types of industries, businesses, individuals and company sizes.

A critical portion of any survey is the response rate. The first step was to attempt to pre-qualify all of the possible survey recipients. Each of the 398 respondents to the CLM survey was telephoned to ask if they would be willing to participate in the dissertation survey. Nearly all that were contacted agreed to participate. Unfortunately, voice mail made it impossible to reach all of the individuals.

Next, all of the CLM respondents were mailed the dissertation survey, a follow-up reminder card and finally a second survey with reminder. The combination of pre-qualifying calls and the three step mailing led to a total of 127 surveys being returned, yielding a thirty-three percent return rate. Table V-1 highlights the overall response rate as of October 18, 1995.

Table V-1
Dissertation Survey Response Rate

Surveys Mailed	392
Returned as Undeliverable	10
Surveys Available to be Completed	382
Completed Surveys Returned	127
Overall Response Rate	33.25%

Note: As of October 18,1995

Since the response rate was not extremely high, the question arises of non-response bias. Fortunately, the overall research plan created a unique opportunity to evaluate whether there was a difference between the two groups of respondents. The

demographics of the respondents were compared based on whether the CLM respondents participated in the dissertation survey. A simple chi-square test of the two groups determined no evidence of non-response bias. Table V-2 presents the results of these tests. It is important to note that the statistical comparison of the industry variable had too many cells, i.e. forty-eight percent of the cells did not have enough responses to be valid. Even with this problem, there was not a significant difference between the respondents and the non-respondents.

Table V-2
Chi-Square Tests for Non Response Bias

Variable	Value	Probability
Industry	27.257	0.128
Type of Business	0.460	0.977
Revenue	2.631	0.452
Title	3.656	0.454

Tables V-1 and V-2 are very important. The thirty-three percent response rate and the lack of a significant difference between respondents and non-respondents allow the data collected to be generalized to the larger population with greater confidence. Given that the data can be more confidently generalized, the respondents' demographics are presented to allow readers to draw conclusions about similar industries, business types, revenues and titles.

The first demographic evaluated was the primary industry in which respondents' firm manufactured, distributed or sold. There were responses from all of the twenty-one possible industries. Table V-3 presents the percent response rates for the most

represented industries. Only one industry accounted for more than fifteen percent of the responses. The food and beverage respondents accounted for just over twenty-five percent of the returned surveys. To ensure that this industry did not bias the results, a chi-square test was performed comparing the food and beverage responses to the other twenty-one industries' responses. Table V-4 presents the results of the chi-square test between industries on the following page.

Table V-3
Industry Demographics

Industry	% of Total
Food and beverage	25.22%
Chemical and plastics	13.04%
Other	9.57%
Pharmaceutical, drug and toilet preparations	7.83%
Clothing and textiles	6.96%
Building materials/lumber products	6.96%
Paper and related products	5.22%
Electronics and related instruments	4.35%
Automotive and other transportation equipment	3.48%
General merchandise	2.61%
Appliances	2.61%
Computer hardware and peripheral equipment	1.74%
Electronic machinery (including parts)	1.74%
Furniture	1.74%
Construction, farm, and garden equipment	1.74%
Machine tools and machinery	1.74%

Table V-4
Chi-Square Test for Food and Beverage Bias

Variable	Value	Probability
Definition of Value	2.629	0.269
Logistics as Cost or Profit	1.183	0.277
Logistics as Core Competency	3.271	0.195
Measure Product Availability	2.211	0.137
Measure Return on Assets	1.678	0.195
Years Measuring Value	1.601	0.659

The chi-square results show that there is not a statistically significant difference between the responses of the food and beverage industries and the other twenty-one industries. This finding suggests that group should not be separated from the other industries in any further analysis.

The second demographic variable was the type of business the company performed. The categories were raw material supplier, manufacturing of components, manufacturing of finished goods, wholesaler and retail store. Table V-5 presents the respondents by percentage.

Table V-5
Type of Business Demographics

Business	% of Total
Finished Goods Manufacturing	57.39%
Wholesaler	16.52%
Retailer	13.04%
Components Manufacturing	6.96%
Raw Material Supplier	6.09%

As with the industry demographic, the types of business responses were weighted towards a single group: finished goods manufacturers. However, the other four responses were more evenly divided. To ensure that the large percentage of finished goods manufacturers did not bias the data, another chi-square test was performed with the same six variables from the food and beverage test. These same six variables were used again to maintain a level of consistency in testing for demographic bias. Table V-6 displays the results of those tests.

Table V-6
Chi-Square Test for Finished Goods Manufacturer Bias

Variable	Value	Probability
Definition of Value	1.433	0.488
Logistics as Cost or Profit	0.011	0.915
Logistics as Core Competency	1.683	0.431
Measure Product Availability	0.177	0.674
Measure Return on Assets	0.006	0.939
Years Measuring Value	2.546	0.467

The chi-square tests reduced concerns about the effect of a very large number of finished goods manufacturers. As with the industry demographic, these tests support the respondents' type of business as representative of the population.

The third major piece of demographic information collected was the company's revenue for the previous fiscal year. In most cases that was 1993 information. The companies provided the revenue information within one of the four categories listed in Table V-7.

Table V-7
Fiscal Year Revenue

Revenue	% of Total
$1 billion or greater	32.74%
$100 million to $499 million	30.97%
Under $100 million	19.47%
$500 million to $999 million	16.81%

The companies' revenue figures are fairly evenly distributed among the four categories. Unlike the previous demographic variables, a single response did not account for a disproportionately large number of the responses. Although large companies ($1 billion and over) account for nearly a third of the companies, the small companies (under $100 million) were nearly twenty percent of the respondents. Again, the chi-square test identified no significant differences between the revenue groups' responses.

The final demographic variable was the respondents' job position within their company. There were five possible choices for the participates: president, vice president, director, manager, and other. Table V-8 presents the title data.

Table V-8
Job Title Demographics

Title	% of Total
Director	39.13%
Manager	34.78%
Vice President	23.48%
Other	1.74%
President	0.87%

Considering the responses for title, the title of president is underrepresented. This may limit any findings as they relate to presidents. However, the other job titles are very well represented with nearly equal responses from the each of the other categories. This is due to the selection process of the survey companies. Since each company's highest level "logistics" person was targeted, it is appropriate that the president was not selected. The president did not have "logistics" in their job title. This should not reduce the value of any findings to logisticians.

One demographic variable not asked was the companies' geographic area of operations. First, the companies were from all parts of the United States and Canada. The responses were not checked to ensure geographic coverage, but it appears that all regions of the US and most of Canada were represented from their mailing addresses. The second part was whether the respondents were regional, national or international companies. Unfortunately, there is not an accurate method to determine the scope of their logistics operations in this study.

In general, the demographic information provides a broad cross section of companies for examination. Two of the variables did show a high response rate from one group. In both cases, however, the chi-square test identified no bias based on these larger groups. In conclusion, the respondents appear to accurately reflect the general logistics population.

Research Hypotheses Testing

This section examines responses to each of the research questions. These nine questions were developed from the propositions' findings in the case study phase. The relevant findings are presented for the nine hypotheses that are tested. Each question is

presented along with the statistical tables. At the end of this section is a summary table of the research question's findings.

Question #1: Do logistical organizations have a definition of value?

H_0: Companies do not report any definition of value.
H_1: Companies report definitions of value.

One of the primary goals of the research was to determine if logistics organizations were defining logistics value. The dissertation survey asked a series of definition type questions. The survey's first question asked if the respondent's company had either a verbal or written definition of "Value?" Table V-9 indicates the response rate for each choice.

Table V-9
Definition of Value

Response	% of Total
No Definition	56.8%
Verbal Definition	24.8%
Written Definition	18.4%

A majority of the respondents' companies did not have any definition of value. Approximately a quarter did have a verbal or informal definition within their organizations. Finally, eighteen percent reported the existence of a written, formal definition of value.

While this may seem discouraging for individuals who believe that logistics does add value, there were significant differences between the companies that did have some form of definition and those that did not. To further understand the effects of having a

definition of value, specific variables were contrasted to identify if there were any significant findings based on whether a company had either a written or verbal definition of value. Table V-10 identifies the significant and non-significant relationships with the variables and definition.

Table V-10
Wilcoxon Test of Definition

Variable	Value	Probability
Logistics as Cost or Profit	4.5287	0.1039
Logistics as Core Competency	9.0647	0.0108
Years Measuring Value	7.7698	0.0510

There were a number of important points based upon the findings of the non-parametric one way analysis of variance. The first was that there did not appear to be a relationship between whether a company had a definition of value and whether it viewed logistics as a cost center or a profit center. The case studies implied such a relationship, but it was not statistically significant (0.1039). At best, these two steps may have a weak relationship.

The next variable was the contrast between whether a company viewed logistics as a core competency, competitive advantage or neither. This finding was statistically significant (0.0108). The key relationship was that the companies that had a definition of value were much more likely to view logistics as at least a core competency. The relationship was not as strong for a competitive advantage. The finding suggests that companies that had created definitions of value either used that definition to create, expand and/or evaluate an existing competency. There was a clear and strong correlation between the core competency and the definition variables.

The last variable dealt with time. There was a relationship between the length of time that a company had been attempting to measure logistics value and whether it had a definition of value. This relationship was significant at the 0.10 level (0.0510). The longer a company had been attempting to measure value, the more likely it was to have a definition of value. It seems reasonable that at some point the organization attempted to develop measures of value. Part of that process would be to define value. Therefore, a longer measurement period leads to a definition of value.

Finally, there was an interesting relationship between the companies' definitions of value and the individual respondents' view. While approximately forty-five percent of companies had a definition, individual respondents had a much higher definition level. Tables V-11 and V-12 present the different rates.

Table V-11
Personal Definition of Value

Response	% of Total
No Personal Definition	33.1%
Personal or Company Definition	66.9%

Table V-12
Comparison of Company and Personal Definitions

Variables	Value	Probability
Company vs. Personal	26.120	0.0001

There was a very clear and strong relationship between these two variables. First, the companies that had definitions guided their employees' views on value. Furthermore, there was a statistically significant larger group of individuals that had views of value even though their company did not (0.0001). This implies that a company definition may not

always be necessary. Two-thirds of the respondents had some form of definition to use as guidance.

This additional set of responses highlighted that many organizations and most individuals had some definition of value. Over two thirds of the respondents either identified that they could define value or provided a written definition with their response.

Furthermore, the definition of value itself was important. When the three other "definition" type questions' variables were compared to value's definition, two had statistically significant relationships with value. The organizations that had a definition of value viewed logistics as at least a core competency if not a competitive advantage. Also, these same companies had been measuring logistics longer than other respondents.

Given the data, there was a clear answer to the research question. Companies reported definitions of value. Also, these definitions were related to other definitions of logistics. The findings strongly supported H_1 that logistics organizations have made some attempt to define value. Furthermore, logistics managers believed that they had some understanding of that value. The statistics supported these conclusions and highlighted the relationships between value, time and view of the logistics department.

The first research question identified that there were definitions of value. This leads to the obvious next point. What are the definitions that were reported? The second research question builds upon the first and examines this issue.

Question #2: Are there common themes between various companies?

H_0: There are not recurring terms or ideas in the definitions.

H_1: Managers and companies use similar terms and ideas in defining logistics' value.

The dissertation survey asked the individuals to provide either their company's or their understanding of "Value" in the provided space. Since this was an open ended question, a content analysis was performed to identify if there were reoccurring terms and ideas in the responses. All of the comments from survey question two are located in Appendix H.

The respondents provided numerous different ideas and terms. However, there were a number of reoccurring themes and terms. These terms and themes covered the expected ideas of cost, price, customer service, etc. However, there were a number of specific examples of terminology that were identified by one or two respondents. Table V-13 presents the total counts of the primary themes.

Table V-13
Content Analysis of Value Definitions

Item or Theme	Responses	% of Total
Customer Service	42	49.41%
Cost	26	30.59%
Return or Profits	22	29.41%
Efficiency	14	16.47%
Quality	13	15.29%
Competitive Advantage or Differentiation	12	14.12%
Time and/or Place Utility	6	7.06%
Item Customers Willing to Pay For	4	4.71%

Note: Definitions may count in more than one category.

Customer service was the most common, reoccurring theme. Nearly fifty percent of the respondents included some form of customer service in their definition of value. The only surprise is that so many individuals included customer service in an open ended question. Some companies viewed customer service as the focal point of value. Other organizations identified it as a portion of the overall definition. Note: To maintain respondent confidentiality, all of the quotations from question two are identified only by their survey number.

- (Value is) Giving our *customers* and *consumers* what they are looking for. #799
- Exceptional *customer service* adds value to our products and existence. #865
- (Value is when) *Customer services* outperform competition. Distribution can be a profit center, not the black hole of your corporation. My distribution centers are the show place, first stop on every tour. Ownership pride. #1552
- (Value is) The ability to provide a benefit to our *customers* which they could not obtain at a similar level or for the same cost. We would like to think the value we provide gives them a competitive advantage. #317

The idea of customer service transcending different companies contributes strong support to the concept that there are common themes between different logistics organizations as well as different companies.

The second most common idea was cost. Almost a third of the respondents stated or implied cost within their definitions of value. These findings seem to confirm previous

research that identified cost as a critical component of measuring logistics. Respondents confirmed that cost remains a critical part of their perceptions of value.

- (Value is) *Costs* and/or *savings* related to a specific task. #945
- In the company "value" is a *financial concept* but also a competitive concept. The logistics functions add "value" by continually *reducing cost* but also reducing cycle time, entrance times and providing service to customers (ship dates, bar code, EDI, etc.). #890
- (Value) Provides worth or *cost reduction*. #653
- (Value is the) *Lowest cost* provider of quality service to our customers. #274

Costs appears to add further support to the idea that there are common terms and concepts between the respondents. Twenty-six of the respondents directly identified cost and cost reduction as a component of value. Another part of cost could include profit based on the view that profit is a combination of revenue and cost. However, profit was identified as a separate category in this analysis.

Return or profit was the next largest group of responses. There were twenty-two profits or return responses that accounted for twenty-nine percent of the total. Many respondents viewed profits as an important part of value. The concept displayed a growing trend of including concepts other than cost in their definition of value.

- (Value is) The *contribution to profitability*, customer satisfaction and market penetration. #1200
- (Value is the) Greatest *return* on every dollar spent. #354

- Value is used as it relates to the shareholder. We use the EVA (Economic Value Added) method to incent managers. EVA is driven *Economic Profit*. *Economic Profit* is the *profit* after taxes in excess of invested capital X the cost of the capital. The change in *Economic Profit* from year to year is EVA. #774
- Economic value added is increase in *economic profit* over a specified period of time. #660

Profit and economic return on investments help to bolster the argument that there are common terms and concepts. The first three concepts were very widely accepted by the respondents. These three provide the strongest support for the second research question. However, there were a number of other reoccurring themes: efficiency, quality, and competitive advantage. Each of these response groups accounted for over fourteen percent of the total responses. In most cases these items were part of the overall definition of value. However, there were a few examples where these items were the key portion of the respondents' definition.

- (Value is) Shipping customers orders complete within three days of release. #829
- *Quality* is defined as the value delivered to the customer. The components of value are the customer's perception of physical product, service and cost. #748
- The ability to provide a benefit to our customers which they could not obtain at a similar level or for the same cost. We would like to think the value we provide gives them a *competitive advantage*. #317

The analysis of the responses identified that these three themes were important considerations to many companies. Although the responses contained fewer references to these ideas, they still demonstrate a high level of similarity across different organizations. If they were examined by themselves, there would not be enough support for the idea of different companies having common themes and definitions. However, when the previous ideas are included, these three provide additional support to H_1 of the research question. These three themes were repeated across companies.

To summarize research question two, the data supported the hypothesis. There were common themes, terms and ideas of value between companies. The most common was the idea of customer service. This seems particularly appropriate given the logistical setting of the research. Additionally, the concepts of cost and profit appeared in many of the responses. These responses imply that the financial aspect of the definition was important as well as customer service. Finally, there were a number of additional themes that appeared in the definitions. These included many of the general business traits of efficiency, quality and competitive advantage.

Question #3: Is there a difference between value and value-added?

H_0: There is not a difference between value or value-added.
H_1: Managers differentiate between value and value-added.

This is the last of the definition type research questions. During the case study research, it was common for individuals to use the terms value and value-added

interchangeably. Therefore, it was necessary to determine not only was there a difference between the definitions, but also was there a difference between the companies' operational methods to quantify logistics value based upon this definition.

The dissertation survey attempted to gather relevant information for this research question. The third question on the survey asked if their company differentiated between value and value-added. The respondents could respond with one of three choices: no; yes, however only in definition terms; or yes, by providing some value-added services to the customer.

The results tended towards the two extremes. Nearly ninety percent of the respondents reported either no difference or value-added services. Table V-14 presents the summary data.

Table V-14
Value versus Value-Added Definitions

Response	% of Total
Value-Added - Service	48.8%
None	40.2%
Value-Added - Definition	11.0%

While only forty-three percent of the respondents reported a definition of value (Table V-9), almost sixty percent of those forty-three percent of respondents reported a difference between value and value-added (value-added - service and definition). Furthermore, forty-nine percent stated they were providing value-added services to their customers. Forty percent of the respondents reported no difference between value and value-added in either definitional or operational terms.

As with the original definition of value (Table V-9), their real interest lies with the results of the comparisons of the differences of value and value-added when contrasted with the other characteristics and variables of the respondents. Table V-15 compares the results of the non-parametic examination of value and value-added with the views of the company in a number of issues and the length the company had measured logistics value.

Table V-15
Wilcoxon Test of Value and Value-Added

Variable	Value	Probability
Logistics as Cost or Profit	0.6456	0.7241
Logistics as Core Competency	8.7965	0.0112
Years Measuring Value	7.8205	0.0499

The first comparison was with the concept of cost or profit center. Clearly there is no relationship between whether companies perceive logistics as a cost or profit center and their view of value and value-added. This presents an interesting contrast to the definition of value. The companies' view about cost or profit center appeared to have a weak relationship based upon whether there was a definition of value at the 0.1039 level (Table V-10). However, there is not a similar relationship between value and value-added with the cost and profit distinction.

The next comparison had an equally strong finding in the other direction. The value or value-added was compared to whether the company considered logistics a core competency or a competitive advantage. If a company provided logistical value-added services, it was much more likely to perceive that logistics was a competitive advantage. This was statistically significant with a value of 0.0112. The implication is that as companies develop value-added services, these companies begin to view logistics as an

area that provides competitive advantage. Although this is a definitional point, there are notable practical implications of this concept. Companies attempting to gain competitive advantage should first have a firm definitional difference between value and value-added. Next, they will need to implement the value-added aspects to gain competitive advantage in their marketplace.

The third evaluation also had a statistically significant finding. As with the definition of value (Table V-10), the companies that had measured or quantified logistics over a longer period of time had developed a difference between the definitions of value and value-added. This is not a major finding in itself. However, it supports the idea that the quantification is an ongoing process that evolves over time.

The findings in Tables V-14 and V-15 provide support to the third research question. Although there is not overwhelming evidence, a majority of the organizations reported differences between value and value-added. However, a large number of companies still perceive no difference between these terms. So the findings of the case studies are still appropriate. In everyday practice, many logisticians do not differentiate between value and value-added. However, there was support for the hypothesis. One must be careful in making broad generalizations from these findings.

Furthermore, the respondents identified two key points with this research question. The first is that companies that differentiate between value and value-added and provide these value-added services identified their logistics operations as a competitive advantage. This may be the most critical and useful finding for practitioners. Also, this question when combined with the first research question highlights the idea of a process that requires a period of time to fully develop definitions and measures of the value of logistics.

The first three research questions all dealt with the definitional aspects of value. Each question asked individuals if they or their companies had definitions of various terms.

Also, the survey asked them to provide their definition of value. This led to a number of important findings that were discussed in each of the previous three research questions. When the three research questions' findings are combined, there are a number of important generalizations that can be made about the responses.

The first builds on the last point of the previous question. Clearly, time plays an important role in the definition process. Regardless of the question, the companies that had been quantifying logistics for a longer period of time had more sophisticated concepts and definitions. Also, they were much more likely to have moved beyond the definitional stage to an implementation of value-added services.

The second point did not have as strong a finding. There was a relationship among the three research questions and the view of logistics as a profit or cost center. Although this was not statistically significant in either definition, the second question identified that both cost and profit were an important part of the quantification process and definition of value (Table V-13). Also, there was some indication that companies with a definition of value were more likely to identify their logistics department as a profit center. However, this was a weak finding. The key point in this area was the importance of cost and profit as a whole. More companies are recognizing the necessity of determining financial measures in addition to the more traditional operational measures.

The third key concept was the view of logistics as a core competency or a competitive advantage. There was a strong statistical relationship between the first and third research questions and the determination of logistics as an area that provided competitive advantage (Tables V-10 and V-15). It appears that the companies that have taken time to accurately define their concepts have then moved on to providing the additional services that increase business. This implies that the definition process is a key step in gaining competitive advantage. Also, this point provided further support for the

idea that this is a process that occurs over time. An additional part of this point may be a periodic reevaluation of a company's definitions to ensure that they still help to provide competitive advantage in their industry or market. This periodic review was an important point from the case studies. It would be logical to apply it to these finding as well.

While the definitional research questions identified a number of key findings, they were only one area of examination in this work. The second group of research questions focused on the specific tools and techniques that industry is currently using. Research questions four and five focus on this topic.

Question #4: Do logistical organizations use similar measurement techniques to quantify the value of logistics?

H_0: Logistics organizations do not use the same measurement techniques.
H_1: There are measurement tools that many logistics firms use to quantify logistics value.

This question could also have been written to read, what tools or techniques do logistics organizations use to measure value? Based on the CLM survey results, the dissertation survey expanded the research with additional questions. First, logistics professionals were asked the extent to which they used the primary twelve measurement tools (identified in the CLM survey) in the dissertation survey question six. This acted as a check to ensure the tools were still being used by these companies. The dissertation survey then went further to identify the amount of use, frequency of use, importance of each tool and the order of techniques' implementation in survey questions eight and nine. The combination of these questions provided the results to research question four. Table V-16 orders the usage of the specific technique from most to least. The sum of the

Table V-16
Amount of Use of Each Technique

Rank	Technique	No. of Respondents	% of Respondents
1	Complaints	122	96.1%
2T	Product Availability	121	95.3%
2T	Inventory Turns	121	95.3%
4	Budget Variance	120	94.5%
5	Order Cycle Time	118	92.9%
6	Order Fill Rate	113	89.0%
7	Line Fill Rate	104	81.9%
8T	Profitability	93	73.2%
8T	Return on Assets	93	73.2%
10	Return on Investment	85	66.9%
11	ABC Accounting	79	62.2%
12	Break-Even Analysis	76	59.8%

percentages does not add to 100%. This is because all the respondents used more than one technique to quantify logistics.

The first observation is that the first six responses were used by eight-nine percent or more of the logistics organizations to quantify. The most widely used tool was the monitoring of complaints. Only five of the respondents did not use this as a method to measure their logistics organizations. There was a tie for the second most common. Both product availability and inventory turns were measured by ninety-five percent of the companies. By themselves, these first three are the basic measures that most companies employ to measure the efficiency of the operations. None of these is effective at

quantifying value. Each is an operational measure of efficiency. However, they may be used as a basis for later quantification in a system or process to measure value.

The fourth response was budget variance. This was the first widely used application that identified cost as a component that must be included to effectively evaluate logistics. As the second research question identified, cost was a key reoccurring theme to professionals. The high use of budget variance implied that managers were attempting to measure logistics in terms of meeting their cost forecasts.

The next three items all focus on operational measures. Cycle time, order fill rates and line fill rates were all heavily used by the practitioners. Just as the first three items did not measure value, these three are traditional efficiency type measures of logistics. The key to these measures will be the ability to quantify value related to performing these operations well.

The final five measures were still used by large numbers of respondents. Almost sixty percent of the companies applied the lowest item, break-even analysis, to evaluate their logistics. It was a reasonable assumption that companies were frequently employing even these lower response items. The second point is that these five items (eight through twelve) are all types of financial measures. While the operational measures dominate, the financial methods appear to be gaining popularity. These methods provide stronger value type information.

An implied part of the research question was that the companies are using the same techniques. The obvious assumption is that they use similar tools. Table V-16 confirmed that even the least popular tools are used by a majority of companies. Additional strength was provided by the most heavily utilized techniques having response rates well above ninety percent. The other way to evaluate this question was to examine how many tools

Table V-17
Number of Methods Used By Respondent

No. of Methods	% of Total
12	35.4%
11	16.5%
10	11.8%
9	9.4%
8	9.4%
7	6.3%
6	3.9%
5	3.1%
4	1.6%
2	2.4%

were used by each company. Table V-17 provides an overview of the number of these tools used by each respondent.

The table provides further support for the conclusion that there is use of similar techniques. Over a third of the companies employed all twelve of the evaluation techniques. The mean was 9.80 with a standard deviation of 2.48. No companies used less than two measures. The majority used ten or more of these measures in combination. Table V-17 added further strength to the concept of common measures.

The last two tables seemed to affirm the obvious. However, there were a number of underlying questions. These questions were based on the finding of similar methods in use. The first was whether a relationship existed between these measures. Another question was whether certain combinations lead to more effective measurement systems.

A final question was can a practical model be developed of these measures. The first two questions will be addressed in the remainder of the research question's section. The model will be discussed in the next chapter.

The possibility of relationships between the variables is important. Since the most heavily used methods had such a high response rate, evaluation between these items would not provide useful data. However, comparison of the less popular techniques identified some critical relationships. Table V-18 identifies which techniques were compared and displays the chi-square value, probability and strength of those relationships.

Table V-18
Relationships between Measurement Methods

Method 1	Method 2	Value	Probability
Profitability	Return on Assets	65.626	0.000
Profitability	Return on Investment	39.511	0.000
Profitability	ABC Accounting	8.733	0.003
Profitability	Break-Even Analysis	34.400	0.000
Return on Assets	Return on Investment	50.947	0.000
Return on Assets	ABC Accounting	21.237	0.000
Return on Assets	Break-Even Analysis	44.659	0.000
Return on Investment	ABC Accounting	7.684	0.006
Return on Investment	Break-Even Analysis	25.535	0.000
ABC Accounting	Break-Even Analysis	22.565	0.000

The first finding of the table was the impressive strength of the relationships. In each case, there was a statistically significant finding. Every combination identified that if the first technique was used the second method was much more likely to be used as well.

These relationships suggested two key findings. The first was that these were all financial measures. A company that had begun to implement value type measures was much more likely to use a set of these techniques. The second key point was that there was a relationship between common methods. There were not only common methods, but also common groups of tools. Companies that were measuring value were more likely to use the group of financial measures beyond the heavily used traditional methods.

Table V-19
Order of Implementation of Measurement Methods

Order	Method	Mean	Std. Dev.
1	Product Availability	3.8288	2.3889
2	Order Fill Rate	4.2243	2.9213
3	Line Fill Rate	4.8200	3.1185
4	Budget Variance	4.8482	2.9750
5	Complaints	4.9478	2.6051
6	Inventory Turns	5.1852	2.7211
7	Order Cycle Time	5.3868	2.5507
8	Profitability	5.9438	3.2903
9	Return On Assets	7.4578	2.9396
10	Return On Investment	7.5000	3.1382
11	ABC Accounting	8.6835	2.7760
12	Break-Even Analysis	9.4054	2.6062

The two related types of measures, financial and operational, raised a question of sequence (Table V-19). Do the traditional operational measures precede the financial techniques? The dissertation survey question asked the company to order the methods

they implemented. Table V-19 identifies the order of implementation. Since a one would be the first technique used, the table is displayed from first to last.

In this case, the first method companies employed was to track product availability. Of the next six measures, five were operational techniques. While the order may not be exactly the same as the use table (Table V-16), there was a common pattern. Once again, the operational tools appeared to be applied more frequently and sooner. However, there was not enough support at this point to draw any conclusions.

There was one more set of data to examine the concept of the differences between the operational and financial measures. The dissertation survey question nine also asked the respondents to weight the techniques based on the amount used (Table V-20). This

Table V-20
Weighted Rankings of Measurement Methods

Rank	Method	Mean	Std. Dev.
1	Budget Variance	14.1051	14.3736
2	Product Availability	13.6786	7.3626
3	Order Fill Rate	11.9007	6.2264
4	Complaints	11.2272	7.5669
5	Inventory Turns	11.0287	9.1118
6	Order Cycle Time	10.6953	7.1003
7	Line Fill Rate	9.6097	5.6219
8	Profitability	9.2719	7.8213
9	Return On Investment	7.0025	5.1550
10	Return On Assets	6.4859	4.8471
11	ABC Accounting	5.1065	4.8411
12	Break-Even Analysis	4.6028	3.9407

required the practitioner to allocate 100 points among the twelve choices.

Again, there was a pattern. Seven of the first eight methods were the operational measures. The respondents did have one surprising change. When the weighting was applied, budget variance jumped to the first position. There was not a clear rationale for this occurrence. However, the case studies hinted that the best method to evaluate the logistics function by upper management was often budget variance. This may account for some of the increase in importance.

Table V-21 presents a summary of the Tables V-16, V-19 and V-20. Table V-21 is the summation of the three variables: amount of use, order of implementation, and weighted rankings. The sums of the three items were used to order the methods with the

Table V-21
Comparison of Rankings

Method	Use	Order	Weight
Product Availability	2T	1	2
Budget Variance	4	4	1
Complaints	1	5	4
Order Fill Rate	6	2	3
Inventory Turns	2T	6	5
Line Fill Rate	7	3	7
Order Cycle Time	5	7	6
Profitability	8T	8	8
Return On Assets	8T	9	10
Return On Investment	10	10	9
ABC Accounting	11	11	11
Break-Even Analysis	12	12	12

lowest first (e.g., product availability = 5 and was the lowest score). The assumption was that a low score indicated a high overall ranking.

Although this was not a scientific ranking, it did highlight the common theme from the three areas. As before, the order was separated into the two basic groups of operational and financial measures. The operational measures repeated the pattern of dominating the first eight positions. The sole exception was the importance of budget variance.

To compare the rankings, two tests were conducted. A Spearman rank correlation coefficient and Kendall's tau were the most appropriate test given the non-parametric nature of the data. Due to the requirement to test pairs of data, there were three sets of paired tests. Table V-22 presents the results of the two tests.

Table V-22
Testing of the Rankings

Variable 1	Variable 2	Spear. Prob.	Kendall Prob.
Use	Order	0.184	0.184
Use	Weight	0.106	0.126
Order	Weight	0.100	0.100

The tests helped to clarify the relationships between the three rankings. The rankings were not significantly different in any of the pairs. The true differences in the tables were the order of the seven operational measures in the first eight positions and the order of the last four financial variables in the last four positions. Even with the differences in positions as just noted, those rankings were not statistically different.

There was support for H_1 based upon the findings in Tables V-16 through V-22. The tools and techniques listed were used by many companies. This finding highlights the

fact the there were common needs to evaluate logistics value across industries and business types. Furthermore, all of the measurement methods were used by a majority of the respondents. The most common measures were used by over ninety percent of the companies.

The second major point was the number of methods used. Half of the companies used nine or more of the twelve methods. The implication is that these twelve techniques were combined to improve the appraisal of logistics. This lends support to an earlier proposition (P_{4b}) that stated that companies used a combination of techniques.

Another finding dealt with the grouping of the methods. In all of the rankings, there was a common pattern. The operational measures were ranked near the top of each of the categories. There was a clear grouping based on the type of measurement: operational or financial. Furthermore, the statistical test confirmed that this was a common pattern between categories.

Finally, there were relationships between the variables (Table V-18). The lower ranked measures, financial, had an extremely high correlation. These techniques were much more likely to be used in combination. If a company employed one of these measures, it is very probable that it will employ the others. This grouping adds importance to the previous point. If a company differentiates between the two types of variables, it was much less likely to use measures beyond the operation tools. This was an important point to managers attempting to design a measurement system.

The next step of the research builds upon the basis established in research question four. The previous question identified the types of measures applied by industry. The logical next step is to identify if the measures are focusing on cost, efficiency or value. The next research question addresses this issue.

Question #5: Are companies measuring costs, attributes, consequences and/or values in their quantification methods?

H_0: Companies do not use costs, attributes, consequences or values to quantify the value of logistics.
H_1: Companies use costs to measure the value of logistics.
H_2: Companies use attributes to measure the value of logistics.
H_3: Companies use consequences to measure the value of logistics.
H_4: Companies use values to measure the value of logistics.
H_5: Companies use a combination to measure the value of logistics.

The hypotheses list a number of different ways to measure logistics value. Some are very straightforward, such as cost. However, the others may be more difficult to examine. Consequences may be based upon the efficiency of the system. Also, they may be a measure of elasticity based on change in the level in service having an effect on the profits.

There are two steps to address this research question. First, this section will address the last part of the hypothesis. H_5 stated that companies used a combination of methods to measure the value of logistics. The dissertation survey question six was used to help gather data. This was the question that asked to what extent a company used a specific measurement technique.

The findings were presented in conjunction with other material in the last research question. Table V-17 identified the point that every respondent used a combination of tools to measure logistics. The majority used nine or more of these techniques. Therefore, there is strong support for H_5 that companies use combinations of measurement tools and techniques. This answers one part of the research question. The remainder of the section will focus on the specific areas evaluated by companies.

The dissertation survey attempted to collect data about what companies were attempting to measure: cost, value or operational performance. Question thirteen asked the organization which of a list of fifteen areas did logistics measure. The second part asked the respondents to identify what types of data were they collecting. The fifteen areas were selected from the findings of the A. T. Kearney three stage model of logistics functions.[148]

If a company reported measuring an area, then it should measure it in terms of value, cost and/or operational performance. The total responses for all fifteen areas were tabulated. These three categories results are in Table V-23. Due to the length of the table, it is on the following page.

The first important point is that none of the respondents measured all fifteen areas in terms of one of the three categories. On the other extreme, many companies did not measure certain areas in one or more of the measurement categories. Nearly a quarter of the respondents did not employ any value type measures. A much lower number of companies did not use any cost or operational performance measures. The basic assumption is that the value measures have a heavy lower tail. Also, the other measures do not have a disproportionate number of responses in either tail. A visual examination of the data supports the point.

However, a visual check is a beginning step. Table V-24 immediately follows Table V-23. It presents summary type information about the three categories. It includes the means, standard deviations, and skewness of value, cost and operational performance.

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[148] A. T. Kearney Management Consulting, Inc., Measuring and Improving Productivity in Physical Distribution, 1984, (Chicago, IL: National Council of Physical Distribution Management, 1984), pp. 18.

Table V-23
Number of Areas Measured by Value, Cost and Operational Performance

# of Functions Measured	Types of Measures					
	Value		Cost		Operational	
	# of Resp.	% of Resp.	# of Resp	% of Resp.	# of Resp	% of Resp.
0	31	24.4%	6	4.7%	9	7.1%
1	21	16.5%	0	0.0%	3	2.4%
2	12	9.4%	1	0.8%	2	1.6%
3	7	5.5%	6	4.7%	6	4.7%
4	14	11.0%	13	10.2%	15	11.8%
5	7	5.5%	12	9.4%	8	6.3%
6	10	7.9%	14	11.0%	18	14.2%
7	3	2.4%	25	19.7%	10	7.9%
8	10	7.9%	15	11.8%	19	15.0%
9	3	2.4%	9	7.1%	8	6.3%
10	6	4.7%	9	7.1%	13	10.2%
11	0	0.0%	7	5.5%	3	2.4%
12	0	0.0%	5	3.9%	6	4.7%
13	2	1.6%	3	2.4%	4	3.1%
14	1	0.8%	2	1.6%	3	2.4%

Table V-24
Average Areas Measured by Value, Cost and Operational Performance

Measures	Mean	Std. Dev.	Skewness
Value	3.5039	3.4454	0.8929
Cost	6.9764	3.0459	-0.0594
Operational Performance	6.7402	3.4829	-0.0751

The statistical examinations supported the visual check. The cost and operational performance categories had very close to normal distributions. However, the value category was heavily skewed to towards the lower tail. Also, the means number of areas measured was higher for the cost and operations categories. The value mean was over three areas lower per respondent. The next step was to test if there is a significant difference among the three categories. Table V-25 presents the comparisons among the three possible combinations.

Table V-25
Comparison of Value, Cost and Operational Performance

Measure 1	Measure 2	Probability
Value	Cost	0.0001
Value	Operational Performance	0.0001
Cost	Operational Performance	0.3589

There was a statistically significant finding of two of the relationships. The use of value measures was much lower than both cost and operational measures. This strengthened the concept of financial type measures not being used as much as identified in

the previous question. The other finding was that there was not a significant difference between the cost and operational performance measures.

The findings of the research provided strong support for H_1, H_2, H_4 and H_5. It was obvious that companies were measuring value and cost. Furthermore, the measures of operational performance could be related to the consequences type measures. This provided weak support for H_3. It was very clear that H_0 could be rejected.

A second set of findings was related to the research question. First, the result dealt with the levels of usage. Companies measured fewer areas in term of value. Of the fifteen areas examined, respondents only measured an average of three and one-half in terms of value. This was significantly lower than the other categories. The same respondents measured the areas with cost and operational performance measures in approximately forty-five percent of the cases.

Unfortunately, the study of this research question remains uncompleted. There is still an opportunity to gather better data on consequences. Attributes were measured easily by the operational type methods. The consequences type measures were not clearly determined within this study. The best approximation was the utilization of a combination of financial and operational measures. This area will be further addressed later in this chapter in the additional findings section.

Research questions four and five focused on the types of measures in use. This included specific methods to collect data and the types of information gathered to evaluate logistics. There were a number of key findings for both of the questions.
They identified that many different tools were not only used, but also employed by many companies. These combinations of techniques measured value, cost and operational performance throughout the organization.

Practitioners should benefit from these findings. The various methods can be adapted to many of the specific companies. The last research question will focus on the transferability of the various measures. Also, the basic numbers provide a starting point for logistics organizations to develop and refine their measurement system. This benchmarking process is examined in the next research question.

Part of the goal of this work is to identify the "leading edge" type systems. The goal is to present specific information that companies can use to benchmark their progress. A critical part of the process is how the company views the logistics portion of its operations. The following research question addresses this issue.

Question #6a: Do companies that have success measuring the value of logistics also identify logistics as a profit center?

H_0: Companies that view logistics as a cost center have not had success quantifying the value of logistics.

H_1: Companies that view logistics as a profit center have had success quantifying the value of logistics.

Question #6b: Do companies that have success measuring the value of logistics also identify logistics as a competitive advantage?

H_0: Companies that view logistics as a core competency have not had success quantifying the value of logistics.

H_1: Companies that view logistics as a competitive advantage have had success quantifying the value of logistics.

This two part research question attempts to determine if there is a positive relationship between measurement success and logistical philosophy. If a company views logistics as a competitive advantage or a profit center, does it have more success

measuring logistics? Although this may seem to be a superficial examination, there are hidden elements that may be critical to developing effective measures.

A simple example can illustrate the importance of the research question. If a company views logistics as a profit center, the logistics manager will operate differently. Cost and budget variance are no longer the driving factors in financial decisions. Furthermore, profitability and value will increase in importance. Therefore, research question six may collect critical data to determine whether that philosophical view of logistics affects the measurement process.

The first tests were to identify if there were any differences between the definitional terms (value, value-added) and this question's terms. Each respondent indicated whether his company considered the logistics portion of the company as a core competency, competitive advantage or neither. Also, these individuals identified if the same logistics area was treated as a cost or profit center. These variables were then compared. Table V-10 presented some of the relevant data. However, many of the other combinations were not included. Tables V-26 and V-27 provide a summary of Table V-10 and include the missing combinations.

Table V-26
Core Competency or Competitive Advantage Comparisons

Variable	Value	Probability
Definition	9.0647	0.0108
Value-Added	8.9765	0.0112
Years	4.1389	0.2469
Cost or Profit Center	3.2364	0.1983

Table V-27
Cost Center or Profit Center Comparisons

Variable	Value	Probability
Definition	4.5289	0.1039
Value-Added	0.6456	0.7241
Years	3.6536	0.3014
Core or Advantage	3.2364	0.1983

A few points could be drawn from the statistical tests. First, there was not a significant relationship between how companies viewed their logistics organizations and time. The companies that had been measuring longer did have a slightly higher number of competitive advantage and profit center responses. However, the differences were not that large.

The second finding was also negative. Table V-27 had all non-significant findings. Regardless of whether a company creates a cost or profit center logistics organization, it has the same level of definitions of value. The only possible exception may be if a definition of value exists. Although it was not significant (0.1039), the probability indicates that it may be more likely to have a definition in a profit center type organization. This appears reasonable due to the requirement of cost and profit centers to use similar accounting measures. This might shape the definitions along traditional "profit, revenue and cost" type issues.

Another point was the relationship between the core competency versus competitive advantage and cost center versus profit center variables. There was not a relationship between these items. Companies may have none, one or both without regard to the other.

The core competency or competitive advantage results were different. Table V-26 identified two significant findings. Companies that perceive logistics to be a competitive advantage should have a definition of value. The same relationship existed between competitive advantage respondents providing value-added services. The ability to gain competitive advantage was predicated on the ability to define and provide value-added.

The next step of the evaluation was to compare the two areas to the twelve measures. Both of the variables were compared with the usage of the twelve measures. Table V-28 displays the results of the table. The twelve measures are ranked in the order of most to least used from Table V-16.

Table V-28
Measurements Compared to View of Logistics Organization

Rank	Technique	Core Vs. Comp. Probability	Cost Vs. Profit Probability
1	Complaints	0.2538	0.5027
2T	Product Availability	0.1626	0.4609
2T	Inventory Turns	0.2317	0.4609
4	Budget Variance	0.6382	0.4238
5	Order Cycle Time	0.0238	0.3604
6	Order Fill Rate	0.6020	0.2633
7	Line Fill Rate	0.9841	0.5123
8T	Profitability	0.0096	0.0447
8T	Return on Assets	0.0443	0.0447
10	Return on Investment	0.2849	0.0195
11	ABC Accounting	0.1649	0.5706
12	Break-Even Analysis	0.6382	0.0064

The table provided mixed results. There was not a clear relationship between all of the measures and either of the views of logistics. However, there were some important relationships between specific measures and those views.

A key point may have been the influence of heavy use measures. The most common methods were used by over ninety percent of the companies. These techniques were so common, those relationship measures between these groups may not be completely accurate. Some of the negative test cells were too small for complete accuracy. However, it was a reasonable assumption to state that there were no major differences between the view of a logistics organization and six of the top seven measures.

There were a few surprises in the top measures. First, the case study findings implied a difference between cost and profit center organizations. It seemed reasonable that there was not a difference between operational measures and the cost or profit view. However, there was not a statistically significant difference between this view and the use of budget variance. The best explanation of this non-difference may be as simple as profit organizations must contain cost as well as cost focused operations.

A second surprise occurred with the core competency and competitive advantage view. As with the cost or profit view, there was little difference among the most common measures. However, there was one key exception. The companies that viewed logistics as a competitive advantage were much more likely to measure order cycle time. The surprise was that the difference was statistically significant. The implication was that competitive advantage organizations were more likely to use speed as a weapon or technique. This use of speed required the accurate measurement of order cycle time to maintain its competitive advantage.

There were other findings that were consistent with the case study findings. The companies that viewed logistics as a profit center used the less common financial measures

more often. There was a statistical difference in four of the five measures. These findings supported the idea that a profit center was more developed in terms of measurement techniques. The sole exception was the use of ABC accounting. There is not a simple reason for the lack of a difference for this variable. It may be the extensive, recent writings on the topic have created interest throughout the industry. This variable provides an opportunity for future research.

The core competency versus competitive advantage variable had two other significant differences. The first was the difference of profitability. The companies that viewed logistics as a competitive advantage were much more likely to measure its profitability. This finding supported case study comments that performing value-added services added profits. These respondents were attempting to measure the changes in profitability based on the competitive advantage type additional services.

The other significantly different measure was the return on assets. As with ABC accounting, there was not a clear understanding of this result. This author was unwilling to speculate on this difference. However, it does provide an interesting possibility for examination at a later time.

The first examination of the data identified a few interesting relationships. There were a number of generalizations that could be drawn from the results. For companies that viewed logistics as either a core competence or competitive advantage, there was little difference between the measures employed. The two key exceptions were order cycle time and profitability. The other generalization was that companies that view logistics as a profit or cost center applied the same operational measures. However, the profit centers were more likely to use the various financial measures. Profit and cost center were equally likely to evaluate financial performance with budget variance and ABC accounting.

A second examination of this view of logistics was performed to gather a more complete understanding. The CLM and dissertation survey results were complied to examine this research question from a slightly different approach.

A problem with this research question was to define success. The CLM survey asked if companies were able to measure and quantify elements of quality in logistics. The literature review noted the fact that many companies used quality as a substitute for logistics value. Therefore, this provided one test variable for comparison between success and the items listed in question six. Table V-29 presents the results of the two CLM questions on success. They asked if the respondents' companies had the ability to measure and quantify quality in operational and financial terms. The responses ranged from one with no ability to measure to seven with high measurement capability.

The data showed that the companies' responses ranged all of the possible answers. Most respondents identified some success measuring quality. However, there was less success in quantifying that quality in terms of dollars or profit. Table V-30 displays the

Table V-29
Ability to Measure Quality

Score	# of Measure Responses	Measure % of Total	# of Dollar Responses	Dollar % of Total
1	10	8.0%	17	13.6%
2	17	13.6%	34	27.2%
3	14	11.2%	18	14.4%
4	22	17.6%	20	16.0%
5	31	24.8%	16	12.8%
6	23	18.4%	14	11.2%
7	8	6.4%	6	4.8%

summary information of the same material. The means and standard deviations confirmed the moderate success quantifying quality and lower level of ability to convert that success into dollars.

Table V-30
Summary of Success of Quality Measures

Variable	Mean	Std. Dev.
Measure Quality	4.1840	1.7102
Quality in Dollars	3.4000	1.7689

These measures help to provide a basis for evaluating the view of logistics identified in research question six. To perform the test, the companies were grouped into two categories based on self reported "success." Either a company had little or no success quantifying value or it had moderate to high success. These groups were compared to the area in question six. These four variables were compared to determine if any significant relationships existed among them. Table V-31 presents the findings.

There did appear to be one relationship. The companies that identified logistics as a competitive advantage were more likely to report success in quantifying quality. However, the results were only significant at the .10 level. These companies were not

Table V-31
Comparison of Core Competency and Cost Center to Success

Variable 1	Variable 2	Value	Probability
Core or Competitive	Measure Quality	5.602	0.061
Core or Competitive	Quality in Dollars	3.385	0.184
Cost or Profit	Measure Quality	0.200	0.655
Cost or Profit	Quality in Dollars	0.159	0.690

significantly more likely to have had success in measuring that quality in dollars.

There were no differences between cost and profit centers. The assumption would be the profit center should be better equipped to measure quality in terms of dollars. The data invalidated this case study finding.

The research question asked if the way companies view their logistics organization affected the measurement success. The research led to a number of important findings. There were significant relationships with each of the views.

The identification of logistics as a profit center had some significant impacts on the other areas. These companies were slightly more likely to have a definition of logistics. Also, they were employing more of the financial measurement tools. Finally, these organizations had a limited amount of "success" when attempting to quantify quality.

The organizations that viewed logistics as a competitive advantage had different effects. The competitive advantage logistics firms had a much higher level of value definitions. Furthermore, these organizations were statistically more likely to employ value-added services. Also, these respondents measured order cycle time more often than the other companies.

Question #7: Is there a most prevalent method?

H_0: There is not a single prevalent technique in use.
H_1: One technique is used by a majority of industry respondents.

This question was designed to determine which of the twelve methods was the most common. It was also created to identify if one of the tools was the most dominate in

use. The first part of this question was addressed previously. In research question four, Table V-16, complaints were identified as the most common. However, the difference between the top five was very small. The weighted set of rankings provided similar results. The primary difference was the budget variance was the type ranked first. Again, the top five were very close.

An additional check was performed based on the responses to the dissertation survey question six. This question had the respondents provide the amount of usage from low equaled one to high equaled seven. Table V-32 presents the relevant data.

This table confirms the findings of the previous tables. The most heavily used item in terms of weighting was product availability. The six most used items were clustered

Table V-32
Amount of Use of Measurement Tools

Method	Mean	Std. Dev.
Product Availability	5.7355	1.5043
Budget Variance	5.3833	1.3973
Order Fill Rate	5.3805	1.7025
Complaints	5.2541	1.4349
Line Fill Rate	5.2019	1.8401
Inventory Turns	5.1983	1.4811
Order Cycle Time	5.0000	1.7638
Profitability	4.4194	1.7088
Return On Investment	4.3765	1.8386
Return On Assets	4.3656	1.8812
Break-Even Analysis	3.4211	1.4990
ABC Analysis	3.3671	1.7481

closely together. This follows the pattern of the other ratings. The product availability measure was also ranked number one in the overall ranking matrix. These points add support to the overall trend of five to six common, heavily used variables.

The results support H_0. There does not appear to be a signal, prevalent technique. The findings identify a group of five to six measures that were used frequently. The most common technique was product availability. However, the mixed results of the various tables identified that various measures were of nearly equal importance. Therefore, there was not a single prevalent technique in use.

A second major point also refers to the previous research questions. The high response rate for the top five to six suggests that there may be a similar concept. While there may not be a single prevalent method, there may be a core and wide-spread group of prevalent methods. The constant grouping of the top measures indicates a trend of these tools forming a core group.

The next research question completes the section on best practices. The last two questions focused on the companies' tools and views. This question attempts to identify if a company's demographics have an effect on their ability to quantify logistics value.

Question #8: Are there common demographics among the companies that report success with the quantification of logistics?

H_0: There are not common demographics between sample companies.
H_1: There are common demographics between sample companies.

Earlier, this chapter presented the demographics of the respondents. Table V-3, V-6, V-7 and V-8 presented the overall demographics. The typical respondent was a

logistics manager or director. Most likely, he worked for a finished goods manufacturer with annual revenues of approximately 750 million dollars. Finally, no single industry was seen to dominate the responses. This wide range of respondents presented a balanced group for the other research questions. For this question, it provided a challenge to identify if there were any important relationships.

There were two possible approaches to examine this question. One method would have been to test every variable compared to the demographic variables. However, this would not have been appropriate for a number of reasons. The first would be that there would have been many significant findings due to the extremely larger number of relationships (5 by 220). The second problem with this type of evaluation is that most of the relationships fail to address the research question. The final fault with that method would have been a combination of the others. With that many possible relationships, a test of that nature would be little more than "data fishing." In other words, that approach would have been a process of identifying multiple relationships and then rationalizing them into results for the research question.

The alternative method was to examine the relevant variables compared with the demographic variables. As with the previous research question, there was a problem of identifying success. To be consistent, the same criteria of success were used to test the demographic variables.

The four primary demographic variables were compared to the ability to measure quality. Also, the same tests were repeated using the ability to quantify quality in dollar terms. A fifth demographic variable was included. The length in years that the company reported measuring logistics provided an additional demographic variable for testing. Table V-33 presents the statistical test findings on the next page.

The general findings highlight that the demographic variables did not have a large number of relationships. However, there were two significant findings based on measurement success. Annual revenue provided the first significant finding. Companies with revenues over of one billion dollars or greater were much more likely to report measurement success. Conversely, the small revenue companies, under 100 million dollars, reported less success. This could be attributed to the more developed logistics organizations in larger companies. These additional individuals may have been responsible for and had time to develop measurement systems.

Table V-33
Demographic Tests of Success

Variable 1	Variable 2	Value	Probability
Industry	Quality Measure	12.433	0.8663
Type of Business	Quality Measure	3.5836	0.4653
Revenue	Quality Measure	12.173	0.0161
Title	Quality Measure	5.3008	0.3803
Years Measure	Quality Measure	10.419	0.0153
Industry	Quality in Dollars	22.569	0.2568
Type of Business	Quality in Dollars	13.693	0.0083
Revenue	Quality in Dollars	2.0724	0.7224
Title	Quality in Dollars	8.7286	0.1204
Years Measure	Quality in Dollars	6.4231	0.0927

The second significant finding was the relationship with the years measured variable. Companies that had been measuring logistics longer reported more success quantifying quality. This is a reasonable finding. These organizations would have had

more time to move down the learning curve and develop a more sophisticated measurement system.

The ability to measure quality in terms of dollars had one significant finding at the .05 level and another at the .10 level. The type of business identified a very significant finding. Wholesalers and retailers reported much more success identifying the dollar changes of different levels of quality. This may be due to the retailers' ability to accurately collect point of sale type data for measurement and examination. However, this would not apply to wholesalers. The best explanation may have been the logistical nature of the wholesale business increased familiarity with the logistics measures.

The second finding was not quite as strong. However, the length of measuring logistics affected the ability to quantify the dollar value of quality. The organizations that had been measuring logistics the longest reported much more success than the other companies. Furthermore, the group with the shortest measurement time had much less success of dollar quantification. This supports the finding of the learning curve. Clearly, the longer a company attempts to measure logistics effects their measurement success.

There were not a large number of significant findings based on the demographics. The lack of significant relationships had important implications as well. No single industry provided a significant finding. This was as interesting as the positive findings. The negative relationship identified that the food industry did not have more success. Therefore, this data did not provide any support that the Efficient Consumer Response type measures were either wide spread or did significantly increased the measurement success.

A second negative finding was the lack of effect by title. Regardless of the individual reporting the data, there were not significant differences based on the

respondent. This was an important finding. The implication was that regardless of the level within the organization, the ability to measure was the same.

The overall findings of this research question were mixed. The results supported H_0. There did not appear to be common demographics among companies that reported success measuring logistics. There were four exceptions to these general findings.

The most important demographic relationship was time. Companies that had been measuring logistics longer had much more success. These organizations were better at measuring and quantifying measurement in terms of dollars.

The other exceptions were the type of business and revenue. The larger companies, more revenue, had more success measuring. Wholesalers and retailers did a better job of identifying the impact of logistics quality in dollars. However, these were the exceptions to the overall trend of no common demographics.

This research question finished the section on the best practices. The three research questions provided a framework to identify a leading edge type company. These companies identified logistics as a competitive advantage. Furthermore, they were much more likely to have a definition of value. This included defining value-added and providing value-added services.

These leading edge organizations had other traits. They were not only likely to employ all of the operational performance measures, but also most of the financial measures. Furthermore, these companies had been measuring logistics for a longer period of time.

This section provided the benchmark type information for practitioners. Also, it identified the traits of a best practice type company. It did not restrict this example to any single industry. The demographic variables were not the key drivers to success in measuring logistics.

The definition of a best practice company raised another key research question. Can the non leading edge type companies adopt these techniques? The final research question attempted to analyze this point.

Question #9: Are the methods transferable between different companies?

H_0: There are not transferable methods that companies can exchange.
H_1: There are transferable methods that companies can exchange.

A key point of the research was to identify measures, definitions and views that could be used by other companies. The previous set of research questions identified some best practice type findings. This question asked if there were certain measures that could be transferred between companies and industries. The goal was to help practitioners identify which measures they could "borrow" from other industries. This information would then be combined with the earlier findings of the order that companies implemented measures to design a measurement process for their company.

The dissertation survey asked a specific question about whether other companies could use the respondents' measures. The survey's twelfth question had respondents rate the twelve logistics measures in terms of transferability. The individuals identified if each of the measures was "easily transferred" to "organization specific" on a seven point Likert scale. Since a score of one represented a measure that could be easily transferred, Table V-34 lists the measures from most easily transferred to organization specific on the next page.

Table V-34
Transferability of Measures

Measure	Mean	Std. Dev.
Inventory Turns	2.3917	1.7017
Order Fill Rate	2.6333	1.8739
Budget Variance	2.6471	1.8893
Order Cycle Time	2.7273	1.7785
Return On Investment	2.7476	1.9439
Line Fill Rate	2.8182	1.8886
Product Availability	2.9508	2.0484
Complaints	3.0240	1.9280
Return On Assets	3.0857	1.9812
Break-Even Analysis	3.1649	1.8635
Profitability	3.2427	2.0121
ABC Accounting	3.5361	1.9260

There were a number of interesting points highlighted by this question. First, every method had responses from easily transferred to organization specific. However, there were specific measures that practitioners identified as more easily transferred between companies.

The first point was the average score of all the tools. Based on the Likert scale, four was the mid point. Every measure's mean was below four. Therefore, even the lowest ranked method was still relatively easy to transfer.

Inventory turns were ranked as the most easily transferable method. The usual group of operational measures followed closely. However, there was one new exception

to the standard pattern of operational measures followed by financial tools. While budget variance often scored well, return on investment placed in the number five position. This was the highest of any financial tool other than break-even analysis in any ranking. This may have been due to the simple and well known formulation of return on investment. This may have helped the perception of return on investment being a fairly easily transferred measurement technique.

The other financial measures were again clustered near the bottom. The last four methods were all financial techniques. The perception of financial methods being more difficult to transfer may account for the lower levels of usage identified earlier in the chapter (Table V-16).

The final method was ABC accounting. It appeared that the respondents did not feel that ABC was as easily transferred. This was reasonable based on the specific measures and drivers developed by each company. Its last place position still scored below the midpoint of four, as noted earlier. The implication was that it was the most company specific of the twelve, but was still quite transferable between companies and industries.

This research question was the most straight forward of the nine in terms of data collection and results. Previous research questions identified the heavy use of many of the tools. This implied that there were methods that could be transferred. Also, the respondents supported the concept that the logistics measures were transferable. Therefore, the data indicated that H_1 was correct. There were transferable methods that companies could exchange.

Summary of Research Questions

Each of the nine research questions was developed to gather information to address the overall objectives of the dissertation. The questions also attempted to provide additional data to confirm or refute the case study propositions. It seemed appropriate to have a summary table after the multitude tables throughout this chapter. Table V-35 summarizes the findings for each of the nine research questions. A positive finding represents the acceptance of H_1 through H_5.

Table V-35
Summary of Research Questions

Question	Concept	Finding	Strength
1	Definition of Value	Positive	Strong
2	Common Themes among Companies	Positive	Strong
3	Value versus Value-Added	Positive	Moderate
4	Similar Techniques	Positive	Strong
5	Costs, Values, Attribute, or Combinations	Positive	Strong
6	Cost vs. Profit and Core vs. Advantage	Positive	Weak
7	Prevalent Method	Negative	Strong
8	Common Demographics	Negative	Moderate
9	Ability to Transfer	Positive	Strong

There were significant findings in most of the research questions. However, certain items did not have much support. In general, the dissertation survey collected the necessary additional data to analyze the research questions.

The respondents identified that there were definitions for value. Furthermore, those definitions had common components. The definitional differences included the difference between value and value-added.

The second part of the research focused on the specific tools used to measure different areas of logistics. The twelve tools identified in the CLM dissertation were examined. They showed that there were common tools being used. Also, the companies were measuring costs, values and operational performance with these techniques.

The next section of research questions attempted to identify best practice type practices. The first finding identified that companies that view logistics as a competitive advantage were more successful in a number of areas. Also, that these companies employed most, if not all, of the measurement techniques.

Finally, the last research question examined the transferability of the various measures. It identified that all of the measures could be transferred between companies. However, the financial measures, especially ABC accounting, were more difficult to move to other organizations.

The research questions provided the backbone of the research. Each of the questions provided useful information. The analysis determined important findings for academics and practitioners alike. However, there were other findings that were beyond the scope of the research questions. The next section presents these additional findings.

Additional Findings of the Dissertation Survey

Just as the case study research revealed surprises, the survey also identified trends and information that were unexpected. Since the dissertation survey consisted of primarily close ended questions, there were not as many additional findings. This section presents the two most important points of these additional findings.

Table V-36
Logistics Responsibility Areas

Area	A. T. Kearney	Dissertation	Change
Outbound Transportation	70%	97%	+27
Distribution Administration	64%	86%	+22
Intracompany Transportation	60%	80%	+20
Distribution Control	56%	83%	+27
Field Warehousing	56%	77%	+21
Distribution Systems Planning	55%	82%	+27
Order Processing	46%	61%	+15
Customer Service	43%	54%	+11
Plant Warehousing	46%	54%	+8
Inventory Management	44%	75%	+31
Distribution Engineering	30%	44%	+14
Production Planning	22%	44%	+22
Sourcing/Purchasing	22%	50%	+28
Raw Material/WIP Inventory	13%	34%	+21
Sale Forecasting	8%	31%	+23

The first deals with the areas measured by logistics. A previous study by A. T. Kearney identified three stages of logistics evolution.[149] In each of the stages were five to six areas that logistics had an impact. This work performed a longitudinal study of fifteen areas. The dissertation's goal was to determine the type of logistics measures being used in these areas. The longitudinal update was an additional benefit to the study. Table V-36 presents both the A. T. Kearney results and the updated information.

[149] A. T. Kearney Management Consulting, Inc., op. cit. #148.

The first point was the dramatic growth in all of the areas. Practitioners were more likely to have logistics responsible for some part of each of the areas compared to the A. T. Kearny study. Only one area did not report double digit growth, plant warehousing. The results showed that the majority of the functional areas increased over twenty percent. These results highlight a tremendous growth in the influence of logistics.

This dramatic growth could be accounted for by a number of reasons. The first was the dissertation sample. The sample group of both surveys was primarily members of the Council of Logistics Management. By definition, this group may have been more likely to employ additional logistics areas. However, it was more reasonable to note that over the time period between studies, logistics did receive a great deal of recognition in the academic journals, the trade journals and the popular press. This was a more sound rationale for some of the growth.

Another simple reason for the growth was time. The thirteen year interval allowed companies time to evolve their measures. While most organizations change slowly, many of these areas were already involved with logistics.

Regardless of the rationale, there appeared to be a dramatic increase in the responsibility of the logistics organization. Even if the increase was over reported by a factor of two, the results still support the concept of the growth of logistics functions and responsibilities.

Another part of this first area was the total number of areas measured by each logistics organization. Table V-37 identifies the mean and standard deviation of the areas each company reported. It is followed by Table V-38 with the total numbers used.

The data showed that most of the companies measured a large number of these areas. This was not surprising based on the large percentage of respondents that included

the most common areas. The typical company measured nine and one-half of these fifteen areas.

Table V-37
Average Number of Areas Measured by Logistics

Variable	Mean	Std. Dev.
Number of Areas Measured	9.5079	2.8078

Table V-38
Number of Areas Measured by Logistics

Number Measured	Responses	% of Total
15	1	0.8%
14	7	5.6%
13	8	6.3%
12	21	16.7%
11	10	7.9%
10	21	16.7%
9	13	10.3%
8	17	13.5%
7	11	8.7%
6	8	6.3%
5	2	1.6%
4	3	2.4%
3	3	2.4%
0	1	0.8%

This first additional finding was merely a step to examine the second point. The key question focused if companies were measuring value, cost or operational performance. This concept was similar to research question five. Question five identified that these types of measures were being used. However, this finding identified where these different types of measures were being employed.

The A. T. Kearney variables provided a useful categorization of logistics functions to measure against. The dissertation survey question thirteen asked if a company measured these areas in terms of value, cost and/or operational performance.

Again due to length, Table V-39 presents the findings on the subsequent page. The table presents the areas in the same order as Table V-36. The scores represent the percentage of respondents that measured that area. However, if logistics did not measure any outbound transportation, they did not count in the overall score for value, cost and operational measures. Outbound transportation provides an example. Ninety-seven percent of the respondents reported that logistics measured outbound transportation. Of that ninety-seven percent, forty-two percent measured outbound transportation's value. Furthermore, eight-nine percent measured cost and seventy-five percent measured operational performance.

It was not necessary to perform any statistical test to identify the large difference between value and the two other measures. However, Table V-25 earlier in the chapter presented the significant difference between the two sets of pairs (0.0001 and 0.0001). Also, there was not a significant difference between cost and operational performance.

The highest value score was distribution systems planning at forty-eight percent. In contrast, the highest cost total was sourcing or purchasing at ninety-one percent. Likewise, the production planning area scored eighty-nine percent. The cost and operational performance measures were much more common throughout the logistics

areas. Furthermore, in only one of the fifteen areas did value score higher than cost or operational performance. The value measure of sales forecasting was three percent higher than cost, but still fifty percent lower than operational performance.

Table V-39
Types of Measures of Logistics Responsibility Areas

Measure	Total	Value	Cost	Ops
Outbound Transportation	97%	42%	89%	75%
Distribution Administration	86%	32%	79%	60%
Intracompany Transportation	80%	33%	89%	72%
Distribution Control	83%	33%	77%	70%
Field Warehousing	77%	38%	89%	78%
Distribution Systems Planning	82%	48%	65%	61%
Order Processing	61%	32%	53%	83%
Customer Service	54%	44%	53%	88%
Plant Warehousing	54%	28%	85%	62%
Inventory Management	75%	41%	73%	79%
Distribution Engineering	44%	45%	70%	55%
Production Planning	44%	30%	48%	89%
Sourcing/Purchasing	50%	44%	91%	65%
Raw Material/WIP Inventory	34%	33%	81%	63%
Sale Forecasting	31%	32%	29%	82%

This first additional finding supports the idea that cost and operational performance measures were still more wide spread and accepted. Logisticians were much more likely to employ the cost and operations measures before value type tools.

However, the lowest score of value measures was twenty-eight percent. That highlighted the fact that value type methods were being employed by a significant number of the respondents.

The second additional finding dealt with time. The key area was how often do companies perform their logistics measurements. Each of the respondents was asked to indicate when the measures were performed. The choices ranged from daily through annually or only at the beginning of a new project.

This data were collected by the dissertation question eight. The responses were coded as daily equals one through annually=six with the beginning of a new project=seven. Considering that this numbering system is not monotonic (i.e., daily=one, weekly=two, monthly=three, quarterly=four, semi-annually=five, annually=six or at the beginning of a new project=seven), all means should be treated as a logarithmic measure. Therefore, a score of two was close to a weekly measure. However, a five was the equivalent of every six months. Table V-40 presents the logarithmic results on the next page.

The top six methods were all operational performance type measures. These were all measured more frequently than the financial measures. Product availability was evaluated on a weekly basis. The next four were all measured between weekly and monthly. The financial measures were less frequent.

The most frequent financial measure was return on assets. It was measured approximately every four months. It was followed closely by profitability. This was a little surprising due to financial reporting requirements from the Securities Exchange Commission. Many on the respondents would be required to file 10-Q reports quarterly. It would be reasonable to assume that a large number of companies would have been tracking their logistics financial measures at least quarterly. However, this appeared to be

Table V-40
Frequency of Logistics Measures

Method	Mean	Std. Dev.
Product Availability	1.9237	1.1778
Order Fill Rate	2.2991	1.368
Complaints	2.4118	1.2783
Line Fill Rate	2.4211	1.6215
Order Cycle Time	3.0090	1.6039
Inventory Turns	3.2018	0.8327
Return On Assets	3.2437	0.8333
Profitability	3.4889	1.2474
ABC Accounting	3.7018	1.6579
Return On Assets	4.6353	1.6536
Break-Even Analysis	5.1231	1.7810
Return On Investment	5.2169	1.7040

the exception and not the rule. The last three financial measures were all longer than the quarterly measure. These three were approximately six to nine months on average.

These findings identified that there was frequent use of the operational measures. Many respondents reported that these measures were performed daily. However, the opposite was true for the financial measures. These measures were often only performed when evaluating a new project or annually. This may account for some of the previous findings of financial measures neither being used as often nor being considered as important as the operational measures. The measures that were used more frequently may be the measures that practitioners believe were more important.

Although there were other findings not covered in the research questions, they could not all be covered in this work. However, the primary two were presented due to their relevance to the research questions. The next chapter includes an additional finding covering the primary or driving force to quantify logistics within the company. Also, the model of a best practice type firm presents a final set of additional findings.

Conclusions

This chapter proved to be more successful than the case study chapter. The surveys provided useful, quantitative data to analyze. All of the research questions were addressed. There were numerous statistically significant findings. Also, the analysis identified relationships between many of the variables and groups.

The data identified the key components of the definition of value. Also, the research questions presented the fact that not only did many of the companies have a definition of value, but also employed value-added services. Furthermore, those value-added services were related to companies that viewed logistics as a competitive advantage.

The section that examined measurement methods provided two major discoveries. The first was that the respondents used most, if not all, of the twelve measures. There was a very high usage of the first six measures. The second major point was the groupings. The financial measures consistently ranked at the bottom of the each of the categories. Furthermore, the companies that used one of the financial measures were statistically more likely to use most of the financial measures.

The best practice questions identified another set of conclusions. The companies that perceived success at measuring considered logistics a competitive advantage. Also,

these companies were more likely to have definitions of logistics value. Finally, the company's view of logistics had an effect on some of the measurement techniques employed.

The last section examined the generalizability of the measurement methods. The examination of the data showed that all the methods were transferable between companies. However, the operational measures were more easily transferred than the financial techniques.

The additional findings section identified two major points. The first was the growth in the number of areas for which logistics was responsible. There was a dramatic increase from the A. T. Kearney study. Also, value was measured significantly less often than cost or operational performance. The other additional finding was the frequency of measures. The operational tools were measured more often than the financial tools.

The chapter provided examination of the specific research questions. The quantitative data allowed the statistical analysis of the issues. This provided the basis to develop the models presented in the next chapter.

Chapter VI - Models

Introduction

The previous two chapters presented the qualitative and quantitative data analysis. The goal of this chapter is to build a set of useful models from those examinations. These models will include both qualitative and quantitative structures, which will be presented throughout this chapter. The chapter also includes a small amount of additional findings not previously addressed. These findings are specific to a portion of their respective models.

This chapter is organized in six general areas. The first section presents a model of value. It provides a straight forward definition of logistics value. The second section provides a Means-End Value Hierarchy Model of Logistics Value. The third area presents a linear regression of success at quantification. Next, this chapter includes a "best practice" type model of the applications. The last model illustrates the process of quantification within the logistics overall process. Finally, a conclusion section ties the models together.

The goal of this chapter is to provide working models for academics and practitioners. Each of the models has strengths and weaknesses. The reader has the option of choosing which best applies to his particular situation.

A Definition of the Value of Logistics

As the literature review identified, there was not a clear or consistent definition of the value of logistics. The case studies and the second research question gathered information from practitioners. Table V-13 displayed the reoccurring themes in the practitioners' definitions.

This section builds a verbal model of value based on the analysis of the second research question. Also, it builds on the definition for value and provides a definition of value-added. These should be useful to both academics and practitioners. These common definitions can be used for research and to assist the implementation of a logistics measurement system.

Many of the components of logistics value are well known. However, none of the definitions were able to incorporate the important themes without unnecessary clutter. The basis of logistics value was identified as customer service. The other important components included cost, profit, efficiency, quality and utility. The following definitional model was based on these and other components.

- The value of logistics is meeting customer service requirements while minimizing supply chain costs and maximizing partners' profits.

A key component of the definition was identifying the customer. This customer may be either internal or external to the firm. The recognition of internal customers was overlooked in some examples. Identifying the customer was a critical step in the process.

Another part of this definition was the customer service concept. This includes all of the basic ideas of time and place utility. It also recognized the more recent ideas of customer satisfaction. To "meet customer service requirements," the logistician must identify the needs of the customer and then fill those desires in a timely and accurate manner. These customer services should include the perception gaps identified in the literature review.[150] [151]

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[150] Parasuraman, A, op. cit. #52.
[151] Foggin, James H., op. cit. #24.

An additional aspect of customer service was that it incorporated the concept of quality. Although some organizations used quality as a substitute for customer service or value, it was considered a subset of customer service. If the logistics organization were to fail to provide a high level of quality, it would disappoint its customers. By definition, a failure in quality would cause the company to fail to satisfy the customer's requirements. The continuous improvement of quality was also implied in customer service. The supplier would have to continuously increase service and reduce cost to remain competitive in the marketplace. The customer will demand that its supplier provide the market levels of service and cost as a minimum.

The second part of the definition was based on cost. The respondents identified that cost, both internal and external, was a critical issue. Not only did a company attempt to minimize its own costs, but it also recognized such that its price was a channel member's cost. Part of the idea of value was providing service that the exchange of cost to service benefited the receiver.

The growing recognition of supply chains influenced this portion of the definition. The concept of ECR supported the idea that logistics recognized that its success was a part of the overall system. Therefore, its internal costs were only part of the cost equation. Many respondents recognized the "big picture" idea of costs throughout the channel. Furthermore, they identified that the long term success of the relationship required that the supplier benefited as well.

The benefit to the supplier was profits. In most cases the company expected a return of some type for their logistics investment. Some companies had begun to treat logistics as a profit center. This area of the company was expected to be profitable and not just an expense.

However, as with cost, there was recognition of the need of the other channel members to be successful. That long term success of the other part of the relationship was identified by some of the respondents. The growth of alliance and partnership concepts led to the idea that the success of the partner was part of the return of logistics. This was true in some of the case studies as well. The idea of profit was more common. Together, they formed a basis for this part of the definition.

The three areas of service, cost and profit effectively incorporate the ideas of customer satisfaction, efficiency, quality, utility, costs and revenue. While this definition is not perfect, it does offer a working model to develop measures and concepts.
In general, the definition of logistics value was not very different from a definition of any business organization. The key components were the identification of the relationship throughout the supply chain and the recognition of the logistics specific operations as part of the customer service portion.

The first part of the definition model was to define value. The second part was to broaden the meaning to include the concept of value-added. The case study companies tended to discuss the concepts of value and value-added interchangeably. However, there were significant differences in the implementation of value-added by the survey respondents.

The concept of value-added was based on the components of value. The definition was very similar. The primarily difference was the inclusion of the idea of value-added providing extra services and including a strategy type concept.

- A logistics value-added service either provides additional service(s) or exceeds customer service requirements that further reduces the supply chain costs or

increases the partners' profits and gains competitive advantage in the marketplace.

The concept of either exceptional or additional service was a major component of the value-added respondents. These extra or better services provided a company with a competitive advantage. The idea was basically the same as value. It builds on the old adage, "If some is good, then more must be better."

Logisticians viewed value-added as a separate class of service that provided more return than value. Although cost did not always go down, the increases in service and profit offset the additional costs. The requirement for an investment meant that all three areas may not be optimized at the same time. Therefore, there was a requirement for an "or" within the definition.

The implied concepts were similar to the value components. These concepts included quality and efficiency. The primary difference was that these aspects were more important in value-added services. These items were the driving factors in gaining competitive advantage. Therefore, quality and efficiency should be more important to a company attempting to provide value-added services.

The other key component of value-added was the concept of gaining competitive advantage. This was an addition to the definition of value. The idea of competitive advantage was moving beyond meeting the customer's need. It implied that the logistical services enhanced the customer's business. However, an additional service does not add value if the customer does not require or desire the procedure. The case studies identified that some additional services were not worth the additional costs.

The two definitional models were designed with the same traits. Therefore, it was expected that they would be very similar. Each incorporated the traditional ideas of time

and place utility within the service portion. Also, the customer service requirements included the more recent ideas of satisfaction, quality and efficiency. Finally, both identified the cost and profit nature of logistics organizations.

The primary difference between the two definitions was the increased focus on delighting the customer in value-added situations. The companies that attempt to gain competitive advantage may use these value-added type services to increase market share. It appeared that some respondents viewed logistics value as part of a tactical process. The companies that provided value-added services identified value-added more as a strategic weapon to compete in the marketplace.

Another key difference was time. Although not identified within the value-added definition, there was a sense of timeliness. The implication was that value-added services have a life span. Over time, the customer begins to perceive these services as normal and no longer as value-added. Therefore, the definition of value-added should be considered time sensitive. Also, this definition provided the model that a value-added service should create a competitive advantage.

The first pair of models presented the definition of value and value-added in verbal terms. However, these definitions only represent a starting point to understanding the underlying relationships of the three major components (customer service, cost and profit). The second model builds on these definitions.

The Means-End Value Hierarchy Model of Logistics Value

Chapter II introduced a Means-End Value Hierarchy Model (MEVHM) using an automobile consumer as an example (Figure II-4).[152] The MEVHM presented an

[152] Woodruff, Robert B., op. cit. #30.

opportunity to display visually the relationships identified both in research question two and the previous model. This section identifies the definition of logistics value in a MEVHM.

The MEVHM shows the customer's values, consequences and attributes. The core value(s) to the customer are displayed at the top of the model. The consequences present the trade-offs the customer is willing to consider when making the selection. Finally, the attributes are the basic items that provide the core services. The model for the value of logistics provides an excellent example of including a social science type model into a business-to-business setting within logistics. Figure VI-1 displays this author's MEVHM for Logistics Value.

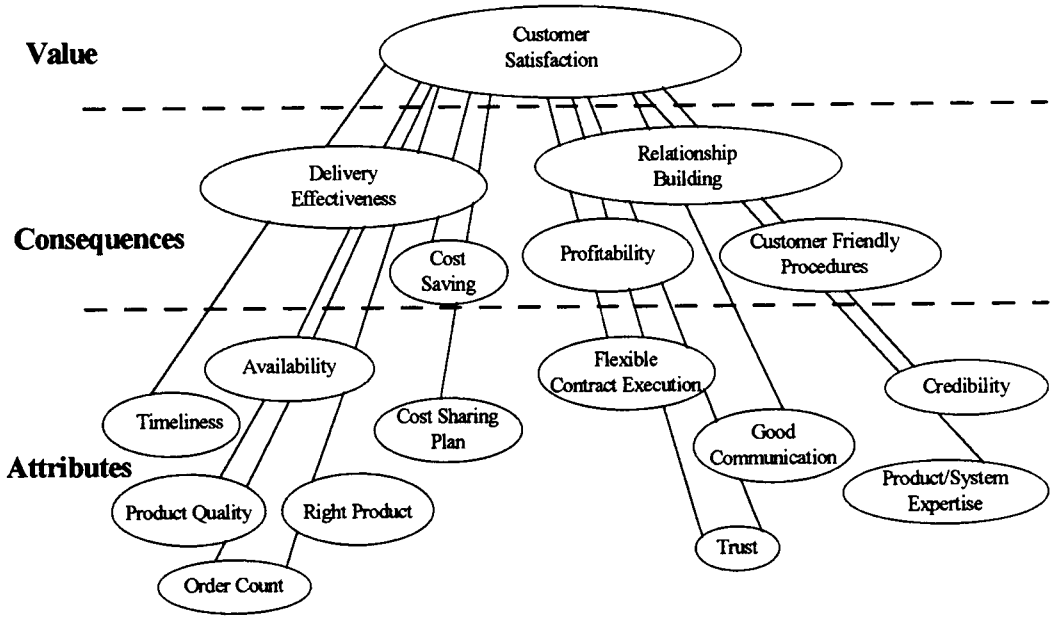


Figure VI-1
Means-End Value Hierarchy Model of Logistics Value

The model was based on the same concepts identified in the previous sections. The key value that logistics purchasers demanded was customer satisfaction. This was similar to the customer service requirements of the verbal definition. The customer values the high level of service at an attractive price with a supplier or channel partner.

The left side of the MEVHM showed the relationship between customer requirements and the basic time and place utility. The consequences were the trade-offs between the effective delivery and additional costs. These two consequences were an integral part of the overall level of customer service. This portion of the model builds upon the concept of effectively meeting the customer's operational needs at an acceptable cost.

These consequences were related to the base attributes. These attributes included the traditional values of logistics such as time and place utility. The model more clearly illustrates the ties between the attributes and the larger concept of customer satisfaction. The consequences acted as the bridge or link between attributes and value.

Two areas of importance in the definition model were cost and profits. These areas contributed to the overall value of customer satisfaction. These both were included within the consequences' section. Each represents the type of trade-offs necessary to perform logistics operations.

The cost and profit consequences were important parts of the overall definition of value. An example of an attribute that supported profits was contract flexibility. The idea was that contracts were designed to ensure both parties were profitable. Also, flexibility was built into the contract to handle special situations. Finally, a successful relationship might include automatic renewal. These were parts of the flexibility of contract attribute.

The idea of contract flexibility spans between profitability and the relationship building consequence. This portion of the MEVHM focused on the concepts of a linked

channel and partnership cooperation. These were important sub-points within the verbal definition of value. Each definition included the recognition of the respondent's logistical organization being part the total channel.

Some of the attributes built on the idea of relationship building. Providing good communication between channel members was important. Due to a limitation of space, a discussion of all the possible attributes will not be included for the relationship building consequence. Each company would have to determine their appropriate attributes based on their customer's specifications.

The relationship building consequence highlighted a key point. There were numerous additional attributes that could have been included throughout the model. This MEVHM was meant as an example and not as an all encompassing final solution. It provides the basic value and consequences of logistics customers. The attributes should differ from company to company and situation to situation. However, there should be much similarity between values and consequences and some consistency between the attributes. Most MEVHMs would include the basic attributes of timeliness, quality, availability, trust, etc.

The MEVHM provides a visual representation of the definition of logistics value. It built upon the verbal definition by including the three basic areas of customer requirements, cost and profits. The model creates a framework that individual companies can modify to meet their specific needs. This includes adding attributes, changing consequences and possibly modifying the value. The MEVHM is an opportunity to help companies visualize their customers' logistics needs. This model is one step in quantifying the value of logistics.

Linear Regression Model of Quantification Success

The first two models were designed based on the findings of the open ended portion of the research. That research was mostly qualitative in nature. It seemed appropriate in a study of quantification methods that the next model should be quantitative. This section provides the linear regression model developed to describe success at measuring value.

As with any regression, there was a requirement for one dependent and various independent variables. The dependent variable selection proved to be a challenge. It was difficult to choose an appropriate dependent variable that represented value. The best choice was the ability to quantify improvements in quality in dollar terms. This variable provided the best combination of service, cost and profit. Quality was a portion of customer service. Also, ability to measure in terms of dollars was part of the cost and profit portions of the written definition. Therefore, this measure provided not only a representation of value, but also a measure of success making it a good choice for the dependent variable.

The second part of the selection process was the independent variables. This step included evaluations of the findings of the case studies and research questions. The research helped to reduce the possible choices. These potential independent variables included the use levels of the twelve measures and the areas measured by logistics. Also, the various definitions were included as dummy variables: definition, value-added definition, logistics as a core competency or competitive advantage, and logistics as cost center of profit center. These thirty-one variables acted as the likely independent variables.

The next step was to determine which of the variables would be included within the model. As with any regression, the inclusion of all of the variables would be

unrealistic. Furthermore, there was a desire to provide a working model for professionals and academics. This implied a limit on the number of independent variables that could be included. These criteria were important to determine which model should be chosen.

The SAS stepwise and all possible regressions statements were run to include all possible combinations of the thirty-one independent variables. With a limitation of ten variables, the best models were identified by the adjusted R^2 values. Table VI-1 presents the best model for each group of variables based on the R^2, adjusted R^2 and Cp scores.

Table VI-1
Comparison of Regression Models

# of Variables	Adjusted R^2	R^2	Cp
1	0.116	0.139	4.574
2	0.207	0.246	1.378
3	0.312	0.363	-2.271
4	0.386	0.447	-4.320
5	0.447	0.516	-5.659
6	0.522	0.594	-7.390
7	0.566	0.642	-7.700
8	0.590	0.672	-7.153
9	0.606	0.694	-6.248
10	0.618	0.714	-5.176

The table identifies that the typical pattern of regressions applies to this data. As additional variables were included within the potential models, the R^2 increased. However, there always comes a point that additional variables fail to justify their inclusion by large growth of the R^2. Also, the number of variables was limited to only ten in the

table. The analysis was performed with all possible combinations to thirty-one independent variables.

The next step was to determine which model provided the most explanatory power without adding unnecessary variables. Based on the criteria, the choices were reduced to the seven, eight and nine variable choices. Each of these provided a high level of explanation. Also, as each added a variable, there was a relatively large increase in the R^2. These three were further compared using the adjusted R^2 and the Cp. These three scores were used to evaluate the choices. The eight variable model provided the best combination of explanatory power, number of variables and Cp score.

- $MQual\$ = +3.2069 -0.3066Use_1 -0.2937Use_5 +0.4074Use_{10} +0.6111CoreComp +0.9357Def -1.5241Per_7 +1.8632Per_8 -1.4522Per_{15}$

Given: **MQual$** is reported successful ability to quantify changes in customer service quality in dollar terms,

Use_1 is the use level of return on investment,

Use_5 is the use level of order cycle time,

Use_{10} is the use level of line fill rate,

CoreComp is whether a company considers logistics as a core competency, competitive advantage or neither,

Def is whether a company has a definition of value or not,

Per_7 is if logistics measures order processing,

Per_8 is if logistics measures customer service,

Per_{15} is if logistics measures sale forecasting.

The final step was to test for multicollinearity. A collinearity check was performed on the eight variable model. The Eigen values and condition numbers were within the limits.[153] The lowest Eigen value was 0.29926 and the highest condition number was 2.86115. Based on these results, there was little multicollinearity among the independent variables.

The model presented some unexpected relationships among the variables. The negative effect of two of the Use variables was surprising. There was not a theoretical basis for the negative values. It may have been caused by interaction among the variables or the exclusion of other variables. Also, a visual inspection of the data failed to identify a strong negative relationship. Regardless, the beta values were relatively small.

A second unusual finding was the high negative values of two of the Per variables. Both order processing and sales forecasting were strongly negatively related. Neither of these measurement areas are directly related to value or profitability. It may have been a case the efforts used to track these areas may have reduced effective measurement in the value areas. Sale forecasting is a planning area where it would be difficult to recognize value without measurements in other areas. The negative values may have been caused by an additional interaction within the model.

The other variables within the model seemed more reasonable based on the previous research. The use of line fill rate as a key measure was reasonable. It was identified throughout the previous chapter as a key operational measure. This model supported the idea that it was also related to value type measures.

Two of the definitional or view type variables were also included. There was a strong relationship between a company that identified its logistics area as a core

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[153] Freund, Rudolf J. and Ramon C. Littell, SAS System for Regression, Second Edition, (Cary, NC; SAS Institute, 1991); pp. 95-99.

competency or competitive advantage. This had a positive correlation. The other definition variable, Def, identified whether companies had a definition of logistic value was related to success in quantifying in dollar terms. Both of these were strong, positive relationships that the previous research supported.

The final positive variable was logistics measurement of customer service. By definition, there should have been a strong relationship between MQual$ and this variable. It provided a large portion of the model's strength. Clearly, the companies in which logistics is responsible for measuring customer service had more success identifying the dollar effects of changes in levels of service.

This model presented the best combination of limiting the number of variables while providing high explanatory power. The adjusted R^2 was 0.5895. Therefore, the majority of the quantification success was explained by the model. Although an adjusted R^2 was not extremely high, it was very good when compared to marketing and social science examination of similar "soft" relationships.

However, there were a number of weaknesses to this model. First, the selection process eliminated over fifty percent of the respondents because of their failure to answer specific questions. This led to a pair of respondent groups. One group answered all of the questions and had a strong relationship with the MQual$ variable. The individuals that did not respond to all the questions were less related to the MQual$ variable. This underlying grouping reduces the strength of the model.

A second weakness was the failure of this study to examine the possible effects of these two groups. This examination was never intended for this research. An opportunity to examine these groups was identified as an opportunity for future research. However, the strength of the linear regression model remains in doubt.

This model raised as many questions as it answered. It identified that there were interrelationships among the variables that must be addressed. Also, the model highlighted the underlying nature of the two groups of respondents. These areas will be addressed in future research.

The model also provided some very useful information. It reaffirmed the critical importance of specific variables. The model can be used as a bridge between the complete qualitative models and the "best practice" model. It helped to clarify which portions of the definitional model and MEVHM should be included within the best practice model. Overall, the linear regression model helped the dissertation advance understanding. However, it was not strong enough to stand as an independent work in its current state.

Best Practice Model

The previous models each built upon the idea of value. The components of each of those models identified the necessary parts of the quantification process. The logical next step was to identify the traits and tools that defined the leading edge type firms. A model of the leading edge firm would include the components of the previous models. A best practice model would also include those specific traits unique to the leading edge type firm. Figure VI-2 presents the Best Practice Model of Logistics Value Measurement.

The Best Practices Model identifies the areas that a company should emulate if it wishes to achieve measurement and logistics value success. The model contains three major parts. The goal of the model is to provide not only an improved measurement system, but also an increase in logistics performance. The other two primary areas of the model are designed to promote that overall goal. These two areas are the framework and implementation steps.

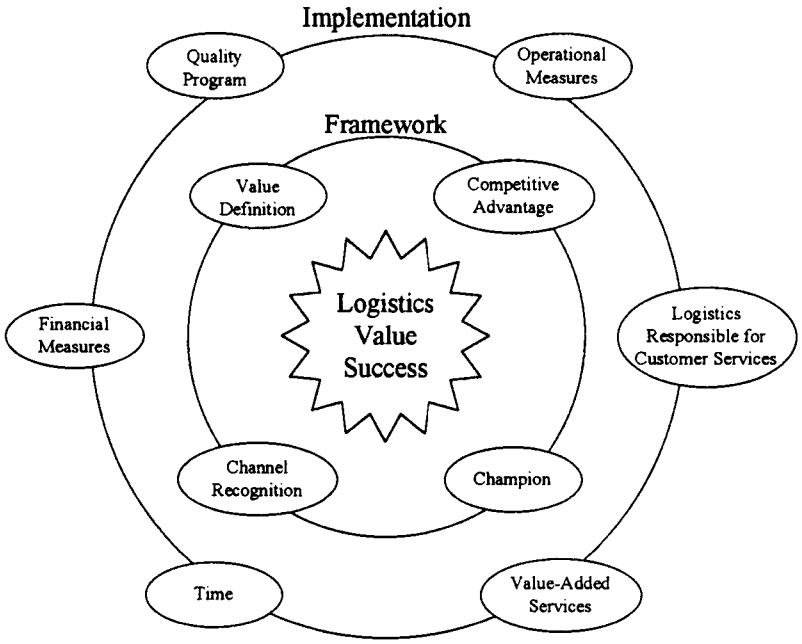


Figure VI-2
Best Practice Model of Logistics Value

The first step was to construct a framework. This step created the foundation for the logistics organization. Best practice type firms included four items within this stage: a formal definition of value, a view of logistics as an area of competitive advantage, recognition of the firm's position as a channel member, and an internal champion of the logistics process. It should be noted that all of these items were relatively equal in importance. The order of their presentation was purely random.

The first two items were discussed in great detail in the last chapter. Both a value definition and a view of logistics as a competitive advantage were statistically shown to be important traits. Therefore, it was appropriate to include them as part of the Best Practice Model.

The third part was the recognition of the company as part of the total supply channel. This was discussed in the case study chapter and briefly earlier in this chapter. This item was important to practitioners when they defined value. They recognized that their success was tied to the other channel members. This "bigger view" was included because of the recognition of the relationship between partners and overall success.

The final part of the framework step was the internal champion. Both the case studies and the survey identified a trend of an internal champion. This individual was responsible for the "selling" or promotion of the logistics area within its parent company. Also, he ensured focus on the measurement process. As with any champion situation, the logistics champion became the driving force for change and improvement within his organization.

These four items were critical to the best practice organizations. The framework items created the necessary foundation for leading edge companies' logistics organization. This portion of the model was the planning or organizational section of the model. By performing these four items, best practice companies created a part of the total process of delivering exceptional service to their customers.

The remaining portion of the model was the implementation step. This step built on the previous framework stage. The implementation items were the result of choices made in each of the framework items.

The first of the six implementation items was the definition, identification and implementation of value-added services. These best companies performed value-added services in both the case studies and survey. The value-added item included the realization that there had to be a system in place to measure the benefits of performing the additional services.

The operational and financial measures support the value-added item. The leading edge organizations performed most, if not all, of both types of measures. There were key differences between normal companies and the best practice organizations. The operational performance measures could be quantified in dollar terms. Another difference was the much higher use of financial measures. The use of financial measures was fairly common. However, the use of multiple financial methods was a difference.

Time was the most simple item. There was a relationship between the length of time a company had performed measurement and their quantification success. Although this seems an obvious item, it was still a key part of the more advanced organizations.

A formalized quality program was included in the model. The case study respondents implied the importance of continuous improvement and Total Quality Management in the logistics area. Also, the definitions of value repeatedly included quality service as part of value. The best companies had a formal quality program.

The final implementation item was the responsibility for customer service. As with time, this seemed to be an obvious item. However, many of the survey respondents stated that logistics was not responsible for customer service or its measurement. This item was another aspect of the successful companies.

The implementation items assisted companies in moving beyond their competition. This second step of the model helped to achieve the model's overall goal of value success. This portion of the model was where logistics organizations performed the day-to-day operations.

The model needed to be tested. A basic examination of the statistics identified that these best practice companies were significantly different from the remaining companies. The companies were categorized based on their responses to the items listed in the model.

Table VI-2 presents the chi-square relationships between the best practice companies and their reported ability to quantify success.

Table VI-2
Comparison of Best Practice and Normal Companies

Variable	Value	Probability
Measure Quality	14.698	0.023
Quality In Dollars	11.218	0.082
Revenue	1.088	0.896

The top five percent, best practice, were compared to the rest of the respondents. There was a clear difference between the two groups. The best practice firms reported much more success at measuring customer service quality. Furthermore, these best practice firms also had more success at quantifying customer service quality in dollar terms (at the 0.10 level). Finally, the measure of revenue was the last attempt to identify success. The results reinforce the concept that revenue may be a better measure of size than success.

The findings supported the best practice model. Those companies that were categorized as the leading edge organizations reported greater measurement success. The implication is that these firms also enjoy greater logistics success. The rationale sounds logical. This conclusion provides another opportunity for future research.

The Best Practices Model provided a useful description of the traits of the more logistically advanced firms. It identified the items employed by those organizations. Most of those items were not unique, however, the combination of the ten items in the two steps identified the leading edge companies.

This model is particularly useful to practitioners. Companies that wish to improve their operations can employ the model as a template. It can be used to benchmark their current system against the respondents' composite process. This could provide logistics managers an overview of their organizations' areas that have an opportunity for improvement.

Implementing Measurements within the Logistics Process

Two of the previous models identified the components of logistics value. They did not explain their part in the logistics process. The use of these items are a critical part of the creation of an effective measurement approach. This portion of the chapter attempts to tie the previous models together into a methodical procedure to create the proper measurement system.

The purpose of this study was not to create a model to implement a logistics strategy. Rather, the goal was to present a method to integrate the quantification of logistics into a company's strategy. Therefore, an existing model was adapted to display the logistics value step.

The Framework for Developing A Service Strategy was used as the basis for this last model.[154] It provided a generalized nine step model to implement logistics operations. This model was particularly appropriate due to the inclusion of a gap analysis that was discussed in Chapter II. Figure VI-3 presents the modified model of the implementation process.

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[154] A. T. Kearney, op. cit. #25, pp. 94.

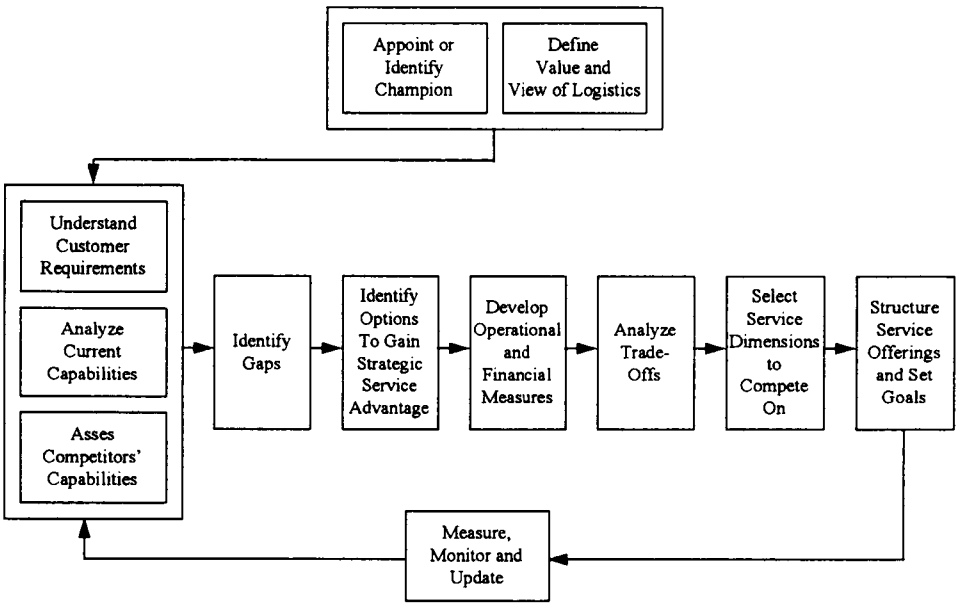


Figure VI-3
Implementing Measurements within the Logistics Process

The A. T. Kearney model has an entire chapter dedicated to its explanation. Therefore, it would serve little purpose to reiterate the description of each of the steps. The modifications by this research are the key to this discussion.

The first modification is at the beginning of the process. A step has been added based on the framework step of the Best Practices Model. Those framework items were included at this point to establish the appropriate logistics environment.

The company should determine whether logistics will be treated as an area of competitive advantage. The recognition of limited resources may force a company not to adopt this view of logistics. Regardless, the other initial items may be performed. A champion for logistics should be either appointed or encouraged to accept the responsibility to guide the process.

The other framework items should be implemented at this point as well. The company should clearly define value for the entire company and for logistics. An implied part of the view of logistics is the recognition of the channel. However, this final framework item is contained within the next step of the model: understanding customer requirements. They help to identify what services the specific company's logistics function capacity. The items help to define the role logistics will play in the process.

The implementation items are also included within the new model. Value-added was one of these items. It is included within the gain service advantage step. These value-added services were found to be a key in gaining advantage earlier.

Next, a step has been included after the company identifies options to gain competitive advantage. This new step is to develop operational and financial measures. These were key implementation items. The evaluation of the possible alternatives requires measurability. This step is necessary to make informed decisions later in the model.

A quality program is implied in the measure, monitor and update step. Just as the definition of value model included quality as an implied sub-component, this model includes it in a similar fashion. This item uses the continuous improvement concept to drive any required reenginering.

Another item is time. This part of the implementation process is spread throughout the model. Also, the circular nature of the model implies the passage of time. Each time an organization moves through the model, it improves its performance and corresponding measures. Each of these iterations moves the company farther down the learning curve and requires time.

One missing area from this model is logistics responsibility for customer service. This may be the option that is evaluated. It was the only best practice item that was not included in this process model.

The Implementing Measurements within the Logistics Process Model was intended as a guide to help the logistics organization plan and execute its operations. This model was not intended as a method to develop new measures. Rather, it was designed to provide the guidance of when the measures should be developed and utilized. The choice or development of measures will remain a research possibility.

This model furnishes academics with a number of opportunities for examination. Each of the steps can be magnified for detailed study. The development and use of specific measures continue to require research. However, the model does improve the understanding of measuring value within the overall logistics process. The quantification section is very important at the beginning of the process. It is necessary to set the framework items in place at the beginning. The actual measurement should occur throughout the analysis and operations process. The use of the measures helps to determine the services that will be offered and to evaluate the services currently in use. This model attempts to clarify where those measures are needed and used.

Conclusions

This chapter provided a number of models. Each attempted to clarify part of logistics value. The models ranged from definitional to process, verbal to visual and descriptive to normative. Each built upon the previous model to present a process of implementing logistics value measurements.

The first set of models defined the value of logistics. Value was defined using the three basic components of customer service, cost and profit. The definition included channel relations and partnerships. These models provided a verbal and visual definition

of logistics value. The MEVHM was the a non-traditional method of presenting value and its relationships. These models included a meaning of value-added.

The next model attempted to identify the components of logistics value in a quantitative model. The linear regression determined the relationship among the independent variables. The dependent variable was the ability to quantify customer service quality in dollar terms. The model appeared to support previous findings of the existence of critical measures and items. However, the strength of the model was limited. The key points were included within the next model.

The model of best practices built on the linear regression and definition models. It highlighted those items that separated the leading edge companies from other organizations. This included the two steps of framework and implementation. This model incorporated ten items that were common to the best practice firms.

The final model described the implementation process. An existing process model was modified to incorporate the additional steps for measurement development. It highlighted the use of the best practice items within the overall process. This model described the steps necessary to not only implement logistics operations but also analyze and monitor the service's value.

All of the models were designed to be useful to academics and practitioners. The basic definitions may be used to provide a common basis for logistics professionals and academics. The linear regression model should allow academics to analyze organizations. The Best Practices Model should help practitioners benchmark their firm's operations. Finally, the implementation model can guide companies attempting to evaluate their current process.

Another important point of the model chapter was the identification of other research opportunities. All of the models contained short comings. These short comings

presented areas that require additional research to confirm or deny the specific model. However, the models presented good starting points for research in the various areas.

There were two major goals of this chapter. The first was to design representative models of the findings of the case study and survey chapters. The five groups of models were moderately successful. As previously identified, there were shortcomings that limited the overall effectiveness of some of the models. In general, the models were able to incorporate the findings of the previous research within their structures.

The second goal of this chapter was to identify useful models for practitioners and academics. The models succeeded in defining value, value-added and best practices. The other models were also useful in identifying processes and quantitative measures. This goal of the chapter was met.

Chapter VII - Conclusions

Introduction

This chapter will briefly review the purpose of the study, the general findings of the research, limitations of the study, contributions of the research and future opportunities. The contributions section will included the managerial and academic implications. This chapter overviews the entire study in a brief synopsis.

Purpose of the Study

The research problem asked two major questions. The first was "How is the value of logistics determined and defined?" The second was "How do logistics managers quantify that value?" This dissertation process was designed to study and answer these two primary questions.

The two major research questions were further divided into four subcategories. The first group of questions attempted to define logistics value. This part of the research included the differences between the definitions of value and value-added. Also, the research attempted to determine if there was a difference between companies that did have different definitions of value and value-added.

The second sub-group of questions examined the quantification practices of companies. This area attempted to identify which measures were in use throughout the industry. Furthermore, there was an attempt to identify the substitutes of the logistics value (e.g., quality). Additional points of examination included the inclusion of financial measures and the combination of various methods into a system.

The next set of questions studied benchmarking issues. This included the best practices of determining value in practice. Also, the dissertation studied the impact of using the best practice techniques on the quantification success of the organization. This area highlighted the necessary items to benchmark against the industry and create success though implementation.

The final sub-group of questions addressed the generalizability of the research. This area included the examination of the transferability of the various techniques. Also, the identification of the best practice items allowed for analysis of the ability to applied them to other companies.

The research of these questions provided the requirements of the data collection. These items framed the case study guideline and the two surveys. These questions were incorporated into the research plan.

The purpose of the study also set the overall goals of the research. The first goal was to identify useful information to practitioners. The purpose of the dissertation was not to be merely an academic exercise. Many of the research interests were designed to meet the logistics manager's needs. However, there was an important contribution to the academic body of knowledge as well. This included a better understanding of the relationships between various parts of the logistics quantification process.

A second goal was to identify a model of the quantification methodology. A research purpose was to develop an understanding of the process for the reader. This model became a series of models based on the analysis.

The overall purposes of the research were very aggressive. The results answered the four primary research areas. It also helped to answer most of the sub-group type questions. The two primary research questions of value definition and the quantification tools were addressed by this research.

Research Plan

There was a deliberate research plan to address the research questions. This plan included the combination of two major studies. The first was the Council of Logistics Management research conducted by Pennsylvania State University, Michigan State University and the University of Tennessee. The second major part was the dissertation study conducted at Tennessee.

The exploratory nature of the study suggested the use of case studies. The case studies were conducted with ten "leading edge" type logistics companies. These interviews provided the basic understanding of the industry's view of logistics value. The case studies helped to develop the next part of the research.

The CLM study included a survey of logistics professionals. This survey identified important trends and helped to confirm the basic themes of logistics value. The combination of the case studies and the CLM survey provided the necessary data to guide the design of the second major study.

The dissertation survey was created based on the CLM findings. The dissertation survey collected information to build upon the CLM study. The information collected in the dissertation survey was combined with CLM data for analysis.

This two step research plan provided the best system to collect the appropriate information to answer the research questions. The combination of case studies and surveys helped to minimize the weaknesses of each method when used separately. At the same time, the combined plan supported the strengths of both case study and survey research. It allowed the collection of both open ended qualitative information and specific quantitative data. This process gathered useful information that was examined to identify the findings presented in the results chapters.

General Findings

The research questions were transformed into propositions and hypotheses for examination. The data were tested to confirm the propositions and hypothesis. A summary table was provided at the end of each chapter identifying the results of the examinations.

Definition of Value

The first set of findings dealt with value. The dissertation survey identified that most companies did not have a formal definition of value. Despite that fact, two thirds of the individual respondents reported a personal definition of value. The case studies and the dissertation survey collected the open-ended information. The data were analyzed to create an overall definition of logistics values.

The definition of value contained three key components: customer service, cost and profit. Each of these was identified by numerous respondents as part of their definition. The model of definition also contained the channel concept and a recognition of partners' needs. All of these items provided two definition models. The verbal model contained the points just addressed.

The Means-End Hierarchy Model of Value provided a different representation of the definition of value. It included the concepts of customer service, cost and profit as well. However, it identified many of the attributes that were traditionally considered part of the value of logistics. This attributes included on-time delivery, damage free service, and others. A key difference of this model was the inclusion of the relationship building consequence. This portion of the MEVHM helped to clarify the importance of channel recognition and maintenance. This section included the non-traditional attributes such as credibility, expertise, communication and trust.

These two models identified the basic nature of logistics value. In addition to the value definition, the second part of the definition phase included an examination of value-added. The same data were analyzed. The majority of respondents stated they either understood or performed value-added services.

The respondents' definitions of value-added made a number of key points. The first was the high number of companies performing value-added type services. Nearly forty percent of the companies performed logistics value-added services for their customers. This high response rate highlights the growing recognition of the importance of being able to provide value-added services.

Another important point was the definition of value-added. The respondents stated that there was little difference between the underlying concepts between the two definitions. As with value, value-added included the basics of customer service, cost and profit. It also identified the channel and partner concept. However, there were two key differences. The first was the idea of extra services or exceptional service. Value-added included one or both of these parts. The other difference was the notion of competitive advantage. A value-added service provided the logistics organization competitive advantage in its market.

The definition area identified three models of value and value-added. This section of the research was a success. It answered one of the two primary research questions. Furthermore, it identified key differences between value and value-added.

Measurements of Value

The measurement section was designed to answer the basic question of which techniques were in use by logistics organizations. Also, were those measures used in combination or was there a dominant method? The dissertation survey was specifically

designed to gather data on the type of techniques, amount of use, frequency of measure and areas using logistics measures. This data provided most of the statistically significant findings.

Twelve measurement tools were evaluated. These included seven traditional operational type measures. Some examples were the efficiency measures of fill rates and cycle time. The remaining five measurement methods were financial measures. Some of these were cost type measures such as budget variance. The other financial measures also included revenue, return on assets, profitability, etc.

The amount of use for the methods identified a key conclusion. All of the methods were used by large numbers of respondents. Over ninety percent of the companies used the five most common tools. Nearly sixty percent of the respondents used the least popular method. These findings highlighted the heavy use of these methods.

The second finding was the use of combinations. The data identified that there was not a single key technique in use. Practitioners were using large numbers of measurement methods. This confirmed the sub-group questions about the use of a combination of techniques.

Another finding dealt with the grouping of the methods. The operational measures dominated every category of comparison. These measures consistently ranked as seven of the top eight. The financial measures were consistently in the bottom four positions. There was a relationship among the use of financial measures. If a company used one of the financial measures, it was much more likely to use the others. There was a consistent difference between the financial and operational measurements groups.

This section also highlighted the fact that many companies used substitutes for logistics value. Both the case studies and surveys identified the use of quality in the process. Many of the respondents identified quality as a sub-component of customer

service. A smaller number substituted quality and quality measures for logistics. Even the survey analysis used quality as a substitute for logistics value in examining portions of the data.

This section of questions was thoroughly examined by the research. It identified not only the basic use issues, but also many of the underlying relationships of logistics value. The findings described many of the techniques in use today.

Benchmarking

The third subset identified the items that the best practice type organization employed. It attempted to isolate the traits of a leading edge firm. Also, a goal was to test if these best practice items were related to logistics quantification success.

Clearly, this section built upon the findings of the previous research. The various examinations of the use of techniques were part of the process. It also included the areas where logistics was responsible for implementing various measures of value, cost and/or operations. The combination of all these points created the Best Practices Model.

The model identified the ten critical items to achieving a best practice organization. There were two primary steps in the process: framework and implementation. The first step identified definitions, the view of logistics and logistics' champion. The implementation step performed the more day-to-day operational functions. These items included measurements, quality, customer service and others.

This model was tested by comparing specific respondents. The leading edge companies were selected based on five categories of variables. The top five percent were then compared to the remaining companies. There was a statistically higher level of success in quantifying both the value of quality and the customer service quality in dollar terms.

This section identified a model of best practices. It was designed to assist practitioners benchmark their organizations as compared to an optimal, leading edge model. It included all the necessary items identified within the research to achieve a competitive advantage based on logistics value.

Generalizability of the Findings

The final subsection was the ability to generalize the findings from one company to another. This section became the easiest to confirm. There were a number of tests to determine the ability to transfer the findings between companies.

The first test dealt with the respondents. The companies came from over twenty different industries. The most heavily represented industry was the food and beverage group. However, none of the groups was large enough to unduly influence the findings. Also, there were various types of businesses included from raw material suppliers through every step of the channel to retailers. Again, there was a reasonable distribution of participants. Even the size of the companies varied from very large to small. The only possible bias of the group was that all were members of the Council of Logistics Management. This was an item that could not be changed within the boundaries of this study. Considering the other demographic variables, this one consistency should not have a significant effect on the results.

A second test of transferability was performed in the dissertation survey. Respondents stated how transferable were each of the measurement techniques. All of the tools ranked in the lower half of the Likert scale. This demonstrated the ease with which most, if not all, of the tools could be transferred.

The models provided another area to assist the transfer of ideas. The models were developed to aid companies attempting to emulate the ideas presented by the case study

participants and the survey respondents. Each model helped identify a part of the findings in a clear and concise manner.

The last set of questions examined the ability to transfer the findings of this dissertation research. It appeared that there would be little difficulty transferring the concepts. The key would be the implementation of the tools at the worker and manager's levels.

Overall, the general findings were presented in Chapters IV, V and VI. The results addressed the two primary research questions and the four subsets of study. The questions were examined by qualitative and quantitative methods. The overall findings were very positive. The dissertation was able to address each point. Although there remains research to be conducted, this study met all of its research goals in its findings.

Key Assumptions and Limitations

There were few assumptions made before the research began. The major assumption was that logistics does add value. The research affirmed this point early in the process. The research attempted to minimize all assumptions.

The next assumption was that the twelve quantitative methods from the CLM survey were sufficient. The dissertation research found that this was not true. The twelve methods failed to identify all of the possible measurement alternatives.

A final assumption was that the use of the CLM database would not bias the results. This still seems appropriate based on the distribution of the respondents' demographics. This is a point that limits the overall generalizability of the findings.

Any other "personal" assumptions were either rejected or confirmed very early in the process. The multiple step research process limited the possibility of influencing the

research with personal assumptions. The influence of assumptions was deliberately reduced in the methodology selection.

There were two major assumptions listed in the Introduction Chapter. The first was that logistics did add value. The research findings supported that point. The other was that companies were developing measures to quantify value. This point was also supported by the research.

Limitations presented a slightly different picture. As with any study, there were some shortcomings in the research. The last section identified the first problem. All of the respondents were members of the Council of Logistics Management. This may have had an influence on the results. Still, this seems like a relatively minor point given the wide range of respondents.

A second limitation was the strength of the linear regression model. There were a number of underlying relationships that were caused by the two groups of respondents. This grouping creates questions that were beyond the scope of this research. The key point was that the model should not be used as an independent definition of value at this time. It should remain as one of a number of checks of logistics value.

The final limitation was based on the exploratory nature of the research. The end result of the dissertation was the development of descriptive and normative models. The exploratory nature precluded a thorough testing of each of the models.

The combined effects of the assumptions and limitations reduce the strength of the findings. However, the limited nature of these items will not have much effect on the overall findings. Furthermore, these minor limitations present opportunities to continue this stream of research.

Contributions of the Research

Managerial Implications

The most obvious managerial implication is the ability to benchmark an organization compared to other logistics companies and the normative model of a best practice firm. This ability alone justifies the work to practitioners. In addition to the benchmarking ability, there were a number of other key implications for managers.

The first was identification of the importance of defining logistics value. This point significantly helped the survey respondents. The Model Chapter provides a collection of basic definitions for the practitioners use. This section included a definition of value-added as well. The value-added definition is important to companies that wish to gain competitive advantage within their industries.

A second major point was the view of logistics within the organization. The managers must identify how logistics is viewed within their company. If it is not as a competitive advantage, the manager must determine if this is a conscious decision due to limited resources or if the potential of the logistics area is being overlooked. This work provides support for bundling the view as a competitive advantage and value-added services together.

Another managerial implication was the inclusion of a process model. That model may be used by managers to guide the implementation of changes developed from other parts of this research. The overall logistics process would benefit from a review based on the model even if reengineering is not the goal.

Managers can use another part of the study as well. Each of the tools identified present a measurement technique to employ in logistics. If a company does not use one of these tools, the study highlights relatively simple techniques that may be incorporated into their measurement system.

The last managerial implication that will be addressed is the location and type of measures that are available. The research identified fifteen areas that logistics should have some involvement in the management or measurement of their services. Managers may use this research to identify relevant areas that logistics should involve themselves within their company. Also, the type of measures in the areas must be addressed. Some appear to only require operation performance measures. Others would benefit from the inclusion of both cost and value measurements. Managers may use this work as a guide in determining their respective needs.

There were numerous managerial implications addressed in this section. Each finding presented relevant information for the logistics professional. Furthermore, all of the models were specifically designed to assist managers to better understand and quantify logistics value.

Academic Implications

Just as there were many managerial implications, there were academic ramifications. The dissertation was designed to assist practitioners. Regardless, the number of implications was greater for the academic community.

The first point was the definitional section. Each of the definitions presented a descriptive model for logistics value. These definitions may be used to either create dialogue about the value of logistics or act as a standardization of the definition for the community. The definition of value-added has similar possibilities.

Another key finding was the identification of the concept of value-added services providing not only logistics competitive advantage but also increased overall success. The relationship between the value-added variable and many of the other variables was an

important finding. The implementation of value-added services was highly related to a number of other areas.

A third implication was the use of the MEVHM in a business setting. There has been little use of this social science tool in logistics. It provided an excellent method to convey the relationships within the definition of logistics value.

There was a longitudinal study of the areas for which logistics was responsible in the company. This was an update of the A. T. Kearney study. The respondents presented a much higher level of responsibility than in the over ten year old data. The drastic increase has practical implications for logistics academics as well. If nothing else, the increase is useful to department heads attempting to justify the inclusion of logistics courses in their curriculum.

Another important implication was the statistical methods used in this study. Most were the common tests used in academia. However, there were two exceptions. The first was the use of a linear regression model and a logit model. The linear regression model was reasonably successful. An attempt to use a logit model did not achieve the desired results. The logit model included just two of the independent variables in the value definition model and one in the value-added definition. The failure to identify a useful logit model is another area that academics should examine. The second statistical method used was the Wilcoxon one way analysis of variance. This technique is less common due to its non-parametric nature. The use of these tools have implications for logistics academics due to its limited use previously.

The academic implications were just as numerous as the managerial ones. The primary items were noted within this section. This dissertation identified a number of important points that may affect the academic community.

Future Opportunities

The limitations of the study provide a number of opportunities for future research. Each of the following opportunities is based on either a shortcoming in the research or a continuation of the current findings. Space limits the listing of opportunities to the primary possibilities.

The first area for additional research is the linear regression model. There should be an analysis of the clusters of respondents. There may be relevant information based on the groupings of respondents. Also, there should be an examination of the differences between the groups. This area is of critical importance to strengthen the linear regression model.

A second part of the further research would be the testing of the models. All of the models need additional testing to determine their validity. The models have received some initial testing, but additional support is required. The MEVHM and linear regression are good examples. The MEVHM requires an examination of the strength of the various relationships among the value, consequences and attributes. The linear regression requires further testing of the relationships between the clusters. These models would benefit from additional testing using confirmatory factor analysis or LISREL. This technique would assist the examination of the strengths of the relationships. The opportunity for additional testing of the models alone will require a number of follow on studies.

Another possible area for more examination was the measurement tools. The findings of this research identified the twelve primary tools in use. However, the high response rates indicate that there should be additional measures that large numbers of companies are employing. These additional, common measures should be identified by follow-on study.

Another opportunity would be to examine the quantification process. More information on the development of measures is needed. Some of the recent literature presented quantification processes. The case studies identified that organizations created measures in a very random and haphazard way. Companies should have a better understanding of the creation of specific measures. This is another potential possibility to continue this stream of research.

This dissertation presented a "snapshot" of the findings. While it advanced the overall understanding of logistics value, it failed to fully explore all the possible alternatives. This section presented possible research streams to further the comprehension of the value of logistics.

Closing Comments

This section concludes this dissertation. In hind sight, there are many little things that I wished I had done differently. There is always that extra question I should have included in the survey. I am very pleased with both the breath and depth of the findings. Although no work is ever perfect, this study answered the primary and support questions of the research. It also has identified a stream of research that I will enjoy working on over the next few years.

I hope that anyone who has made it this far found something in this work that satisfied the investment in time and effort to get to the end. These feelings are expecially directed to all of the committee members who have had to read each page. The findings come through despite my somewhat stilted writing style.

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Appendices

A: Case Study Participating Companies

B: Case Study Interview Guide

C: CLM (Team) Mail Survey

D: Follow-Up Dissertation (Individual) Mail Survey

E: Case Study Abstracts

F: Corporate and Logistics Profiles

G: Federal Express Business Logistics Services: Logistic Financial Impact Workbook Summary

H: Research Question #2 Responses

Appendix A - Case Study Participating Companies

Food

Coors Brewing Company

Nabisco, Incorporated

Welch's

Consumer Products

The Proctor & Gamble Company

Pharmaceuticals/Medical Supplies

Becton Dickinson and Company

High Tech/Computer

National Semiconductor

Unisys Corporation

Retail/Wholesale

Crystal Brands, Incorporated

Kaska Distributing Company

L. L. Bean, Inc.

Appendix B - Case Study Interview Guide

QUANTIFICATION OF LOGISTICS VALUE
CASE STUDY GUIDE

COMPANY NAME_____

DATE:_____

LOCATION:_____

LOGISTICS CONTACT:_____

TITLE_____

OTHER CONTACTS:_____

_____

_____

I. **GENERAL DEFINITIONS**

A. HOW DO YOU DEFINE LOGISTICS?

B. HOW IS LOGISTICS ORGANIZED IN YOUR FIRM?

C. HOW DO YOU DEFINE LOGISTICS VALUE?

D. DO YOU THINK LOGISTICS QUALITY AND LOGISTICS VALUE ARE RELATED?

II. **GENERAL METHODS OF QUANTIFICATION**

A. HOW HAS YOUR FIRM BEEN ABLE TO QUANTIFY LOGISTICS VALUE?

B. WAS THERE ANY SPECIFIC REASON THAT YOUR FIRM SAW THE NECESSITY TO QUANTIFY THIS VALUE?

C. AT WHAT LEVEL WITHIN YOUR FIRM DID THIS INITIATIVE BEGIN? WHEN DID IT BEGIN?

D. WHERE IS THE QUANTIFICATION PERFORMED (I.E., WHO DOES THE ANALYSIS)?

E. WHO USES THE RESULTS OF THIS ANALYSIS AND FOR WHAT PURPOSES?

F. WHAT ARE THE DATA SOURCES FOR THE ANALYSIS?

III. **COST REDUCTION METHODS AND EXAMPLES**

A. IN WHICH LOGISTICS AREAS HAVE YOU BEEN ABLE TO QUANTIFY THE RELATIONSHIP BETWEEN COST CHANGES AND PROFIT/REVENUE CHANGES?

B. WHAT TYPES OF COSTS ARE INCLUDED IN YOUR METHODOLOGY (E.G., INVENTORY COSTS, LABOR, ETC)? WHY ARE THESE PARTICULAR COSTS USED?

C. HOW DO YOU CALCULATE THE RELATIONSHIP BETWEEN LOGISTICS COSTS AND FIRM REVENUE/PROFITS?

D. DO YOU HAVE ANY CASE EXAMPLES OF WHERE AND HOW THIS METHODOLOGY HAS BEEN USED?

E. HOW DO YOU KNOW THAT CHANGES IN LOGISTICS COSTS IMPACT YOUR FIRM'S REVENUES/PROFITS? DO THESE RELATIONSHIPS GO BOTH WAYS? ARE THEY STRONG OR WEAK RELATIONSHIPS?

III. **SERVICE REDUCTION METHODS AND EXAMPLES**

A. IN WHICH LOGISTICS AREAS HAVE YOU BEEN ABLE TO QUANTIFY THE RELATIONSHIP BETWEEN LOGISTICS SERVICE CHANGES AND PROFIT/REVENUE CHANGES?

B. WHAT TYPES OF SERVICE ELEMENTS ARE INCLUDED IN YOUR METHODOLOGY (E.G., PRODUCT AVAILABILITY, ORDER CYCLE TIME)? WHY

ARE THESE PARTICULAR LOGISTICS SERVICE ELEMENTS USED?

C. HOW DO YOU CALCULATE THE RELATIONSHIP BETWEEN LOGISTICS SERVICE AND FIRM REVENUE/PROFITS?

D. DO YOU HAVE ANY CASE EXAMPLES OF WHERE AND HOW THIS METHODOLOGY HAS BEEN USED?

E. HOW DO YOU KNOW THAT CHANGES IN LOGISTICS SERVICE LEVELS IMPACT YOUR FIRM'S REVENUES/PROFITS? DO THESE RELATIONSHIPS GO BOTH WAYS? ARE THESE RELATIONSHIPS STRONG OR WEAK?

IV. REVENUE GENERATION METHODS AND EXAMPLES

A. HOW DO YOU CALCULATE YOUR FIRM'S REVENUES?

B. WHAT METHODOLOGY DO YOU USE TO LINK LOGISTICS SERVICE AND COSTS TO YOUR FIRM'S REVENUES? THAT IS, HOW DO YOU KNOW THAT LOGISTICS COSTS/SERVICE ARE AFFECTING PROFIT/REVENUE LEVELS?

C. HOW DO YOU DISTINGUISH AMONG THE LOGISTICS CONTRIBUTION, MARKETING CONTRIBUTION, AND PRODUCT CONTRIBUTION TO REVENUE/PROFITS?

VI. **MANAGEMENT (OPERATIONS) IMPLICATIONS**

A. HOW HAVE YOU BEEN ABLE TO USE THE RELATIONSHIPS BETWEEN LOGISTICS COSTS/SERVICE AND FIRM PROFITS/REVENUES IN MANAGING YOUR AREA WITHIN THE FIRM?

B. DOES UPPER MANAGEMENT RECOGNIZE THE IMPORTANCE OF LOGISTICS SERVICE/COST MANAGEMENT? HOW?

C. ARE YOU ABLE TO CALCULATE AN "ROI" FIGURE TO HELP GET FUNDING FOR LOGISTICS INVESTMENTS? HOW? ARE OTHER FINANCIAL METHODS, SUCH AS NET PRESENT VALUE, ALSO USED?

VII. ADVANTAGES AND DISADVANTAGES

A. WHAT ARE THE ADVANTAGES OF BEING ABLE TO QUANTIFY LOGISTICS VALUE? TO YOUR DEPARTMENT? FIRM? CUSTOMERS?

B. WHAT ARE THE DISADVANTAGES?

C. HOW DO YOUR CUSTOMERS REACT TO THIS ABILITY?

D. DO YOUR COMPETITORS HAVE THIS ABILITY?

E. DOES THIS ABILITY GIVE YOUR FIRM A COMPETITIVE ADVANTAGE?

F. WHAT DO YOU SEE AS THE NEXT STEP FOR YOUR FIRM IN THE QUANTIFICATION OF LOGISTICS VALUE?

VIII. **ADDITIONAL COMMENTS**

Appendix C - CLM (Team) Mail Survey

Quantification of Logistics Value

Robert A. Novack
Center for Logistics Research
Penn State University

C. John Langley, Jr.
Center for Logistics Research
The University of Tennessee

Lloyd M. Rinehart
Department of Marketing and Logistics
Eli Broad Graduate School of Management
Michigan State University

May 1994

PENNSTATE

Introduction

Throughout the evolution of logistics there have been a number of significant attempts to identify and measure the magnitude and importance of logistics. While studies such as these are excellent in many respects, it is clear that there is considerable opportunity to learn more about how logistics creates or adds value, and how this value can be quantified. The purpose of this research, funded by the Council of Logistics Management, is to fill this void by attempting to understand and quantify the nature of the relationship between logistics service and cost improvements, and a firm's revenues and profits.

PART I: Logistics Activity Costs and Performance

1. Ten logistics activities have been identified in the list below. For each of the activities, please answer two questions. First, indicate whether or not your firm measures the *cost* of performing each activity by placing a mark in the appropriate column. Second, indicate whether or not your firm measures the *performance* level of each activity.

	Measure Costs			Measure Performance		
Activity	Yes	No	NA	Yes	No	NA
Purchasing	___	___	___	___	___	___
Inbound Transportation	___	___	___	___	___	___
Packaging	___	___	___	___	___	___
Inventory Mgmt. (RM, WIP, FG)	___	___	___	___	___	___
Warehousing (RM, WIP, FG)	___	___	___	___	___	___
Manufacturing (Production, operations)	___	___	___	___	___	___
Intra-Company Transportation	___	___	___	___	___	___
Order Processing	___	___	___	___	___	___
Outbound Transportation	___	___	___	___	___	___
Logistics Design and Strategic Planning	___	___	___	___	___	___

2. We would also like you to rank them against one another on two different scales. *First*, rank them on their *relative total cost* to your firm, with the activity assigned a "1" being the most costly and the activity assigned a "10" being the least. *For example*, if inbound transportation is the highest cost, it would be ranked "1," if warehousing is the second highest cost, it would be ranked "2," and so on.

Second, using the same type of scale, rank each of the activities by its *relative creation of value* for your firm based on your perception of its performance, with a "1" being assigned to that activity that adds the most value and a "10" assigned to the activity that adds the least value. *For example*, if purchasing adds the most value, it would be ranked "1," if order processing is the second highest value adding activity, it would be ranked "2," and so on.

Activity	Cost	Perception of Value
Purchasing	____	____
Inbound Transportation	____	____
Packaging	____	____
Inventory Mgmt. (RM, WIP, FG)	____	____
Warehousing (RM, WIP, FG)	____	____
Manufacturing (Production, operations)	____	____
Intra-Company Transportation	____	____
Order Processing	____	____
Outbound Transportation	____	____
Logistics Design and Strategic Planning	____	____

PART II: Measurement of Logistics Service Performance

1. For the following five logistics service outputs, please indicate whether or not your firm measures its performance of each and rank them from 1 through 5, with "1" being the most important logistics service your firm provides and 5 being the least important. *For example*, product availability is most important (1), followed by order cycle time (2), postsale customer support (3), and so on.

Logistics Service Outputs	Measure		Relative Rank
	Yes	No	
Product Availability	____	____	_____
Order Cycle Time	____	____	_____
Logistics Operations Responsiveness	____	____	_____
Logistics System Information	____	____	_____
Postsale Customer Support	____	____	_____

2. Within each major logistics service output, certain subcategories have been identified. Please indicate for each subcategory: (1) whether or not your firm measures it, and (2) its relative importance to the others within that category. *For example*, under product availability, rank the subcategories from 1 through 4 based on their relative importance, with a "1" being assigned to the most important and a "4" being assigned to the least important.

	Measure		
	Yes	No	Relative Rank
Product Availability			
Order Fill Percent	___	___	_____
Percent Orders Complete	___	___	_____
Loss/Damage Percent	___	___	_____
On-Time	___	___	_____
Order Cycle			
Length	___	___	_____
Reliability	___	___	_____
Ability to Shorten When Needed	___	___	_____
Meet Customer Requirements	___	___	_____
Logistics Operations Responsiveness			
Meet Requested Ship/Delivery Dates	___	___	_____
Expected Delivery When Needed	___	___	_____
Proficiency in Handling Problems/Complaints	___	___	_____
Overall Flexibility and Adaptability	___	___	_____
Logistics System Information			
Order/Shipment Status	___	___	_____
EDI Capabilities	___	___	_____
Accuracy/Timeliness of Paperwork and Documentation	___	___	_____
Timely Notification of Problems, Shortages, Late Deliveries, "Cuts," etc.	___	___	_____
Postsale Customer Support			
Availability of Spare Parts	___	___	_____
Delivery of Repair/Replacement Parts	___	___	_____

3

PART III: Measurement of Logistics Value

1. The term "value" is meant to include a change in your firm's revenues or profits because of a change in one of the five logistics service outputs. *For example*, a change (either up or down) in product availability might result in a change (up or down) in revenues because of a customer reaction. Likewise, a change in the cost of providing product availability might result in a change in your firm's profits.

   For the following question, we would like you to circle the number in each box that represents the strength of the relationships that *you believe* to exist, with "0" being no relationship and a "3" being an extremely strong relationship. *For example*, if you think that an increase in product availability service results in a very high increase in your firm's revenues from its customers, circle the number "3" in that box. If a decrease in postsale customer support has little or no impact on a revenue decrease, circle the number "0."

   Also, place a circle around the "X" in either of the boxes that your firm has been able to quantify. *For example*, if your firm has been able to determine that a 1% increase in product availability results in a 2% increase in revenues, circle the "X" in the Service Increase/Revenue Increase box for product availability.

	Potential Relationships			
Logistics Service Outputs	Service Increase/ Revenue Increase	Service Decrease/ Revenue Decrease	Cost Increase/ Profit Decrease	Cost Decrease/ Profit Increase
Product Availability	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X
Order Cycle Time	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X
Logistics Operations Responsiveness	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X
Logistics System Information	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X
Postsale Customer Support	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X	0 1 2 3 X

2. If you were able to indicate that your firm has quantified the relationship between logistics and value, would you be willing to share your methodology with us for the next phase of this research?

_____ Yes _____ No

If you indicated "yes," please identify the person we could contact:

Name: _____

PART IV: Perceptions of Logistics Value

1. On a scale of 1 to 7 (with 1 being strongly disagree and 7 being strongly agree), rate the following statements based on *your perceptions*.

	Strongly Disagree						Strongly Agree
Improving logistics productivity is a high priority in our firm.	1	2	3	4	5	6	7
We are constantly trying to reduce overall logistics costs.	1	2	3	4	5	6	7
We view achieving productivity through quality as critical to our success.	1	2	3	4	5	6	7
Our customers are not pleased with the levels of logistics service we are giving them.	1	2	3	4	5	6	7
We are constantly trying to increase our overall logistics service levels.	1	2	3	4	5	6	7
We provide more logistics service than our customers actually need.	1	2	3	4	5	6	7
Our customers reduce their business with us when logistics service levels are below their expectations.	1	2	3	4	5	6	7
Upper management is aware of the sales impact of changes in logistics service levels.	1	2	3	4	5	6	7
We are able to measure and quantify elements of quality in logistics.	1	2	3	4	5	6	7
We are able to express the value of these logistics quality measures in dollar terms.	1	2	3	4	5	6	7
Upper management is aware of the cost implications of changes in logistics service levels.	1	2	3	4	5	6	7

5

	Strongly Disagree						Strongly Agree
Our customers increase their business with our firm when logistics service levels meet or exceed their expectations.	1	2	3	4	5	6	7
Our customers notice when logistics service levels exceed their expectations.	1	2	3	4	5	6	7
Logistics adds value to our firm's output and provides a competitive advantage for my organization.	1	2	3	4	5	6	7

PART V: Specific Logistics Activity Cost Estimates

1. Recognizing that there are many logistics activities, we would like to assess specific cost estimates in three of these areas (system inventories, system transportation, and system warehousing) for your firm's latest fiscal year. *Please express these costs in dollar terms, not as a percent of revenue.* For each activity please identify the specific cost in three areas. **Procurement** is the cost associated with buying inventories (for resale), transportation, and warehousing. *For example*, if your firm uses for-hire carriers or public/contract warehouses, indicate how much was spent by your firm on these third party services. **People** is the cost associated with the personnel your firm utilizes to either *procure* inventories, transportation, and warehousing or to *manage* private operations in these areas. **Assets** is the cost associated with the physical assets your firm owns in these areas. Some categories might not apply to your firm. *For example*, if you do not utilize a private fleet, then place an "N/A" on the question dealing with "Transportation Assets."

   Also, on the scale to the right of the matrix, please indicate the level of confidence you have in the dollar estimate by circling the appropriate number. This is provided for a situation where a logistics activity area is not under your control and you needed to rely on another functional area for the estimate.

	Cost	Confidence in Estimate Low				High
A. Specific annual cost for inventory procurement for resale (no form change).	_____	1	2	3	4	5
B. Specific annual cost for inventory procurement personnel.	_____	1	2	3	4	5

		Cost	Confidence in Estimate Low				High
C.	Specific annual cost of inventory procurement for form conversion (manufacturing).	_____	1	2	3	4	5
D.	Specific annual cost purchased for-hire transportation.	_____	1	2	3	4	5
E.	Specific annual cost of personnel to buy for-hire or manage private transportation services.	_____	1	2	3	4	5
F.	Specific annual cost of operating a private fleet.	_____	1	2	3	4	5
G.	Specific annual cost of purchased public/contract warehousing.	_____	1	2	3	4	5
H.	Specific annual cost of personnel to buy public/contract warehousing or manage private warehousing.	_____	1	2	3	4	5
I.	Specific annual cost of operating private warehouses.	_____	1	2	3	4	5

If you were able to provide dollar estimates for these areas, please go to "Part VI: Demographics."

2. If you did not supply dollar estimates for the preceding question, why not?

_____ Our firm does not capture these costs.

_____ Areas not under my control.

_____ No time to compile dollar figures

_____ Other (please specify) _____

_____

7

PART VI: Demographics

Please take a moment to fill out the following demographic questions. These will be used as the basis to aggregate your responses to this survey.

1. Please indicate the one industry below which best describes the products your firm manufactures, distributes, or retails.

_____ Appliances
_____ Automotive (including parts and after-market) and other transportation equipment
_____ Building materials/lumber products
_____ Chemicals and plastics
_____ Clothing and textiles
_____ Computer hardware and peripheral equipment
_____ General merchandise
_____ Electronics and related instruments
_____ Electronic machinery (including parts and supplies)
_____ Food and beverage
_____ Furniture
_____ Hardware
_____ Construction, farm, and garden equipment
_____ Machine tools and machinery
_____ Mining and minerals
_____ Office equipment and supplies
_____ Paper and related products
_____ Petroleum and petrochemicals
_____ Pharmaceutical, drug, and toilet preparations
_____ Primary metals
_____ Rubber products and related goods
_____ Other (please specify) _____

2. Please classify your firm based on its predominant form of business (please check the one most resembling your organization).

_____ Raw material supplier for manufacturing

_____ Manufacturing (Components)

_____ Manufacturing (Finished Goods)

_____ Wholesale

_____ Retail

3. What were the annual dollar sales for your organization during the most recent fiscal year?

_____ Under $100 million

_____ $100 million to $499 million

_____ $500 million to $999 million

_____ $1 billion or greater

4. Which of the following best represents your position within your firm?

_____ President

_____ Vice President

_____ Director

_____ Manager

_____ Other (please specify) _____

5. If you would like to receive a summary of the results of this study, please provide the following information so we can mail the findings to you directly. (The code number on this page is for identification purposes only.)

Name _____

Title _____

Company _____

Address _____

_____

_____

Phone (____)_____

9

THANK YOU FOR YOUR HELP!

Return to:

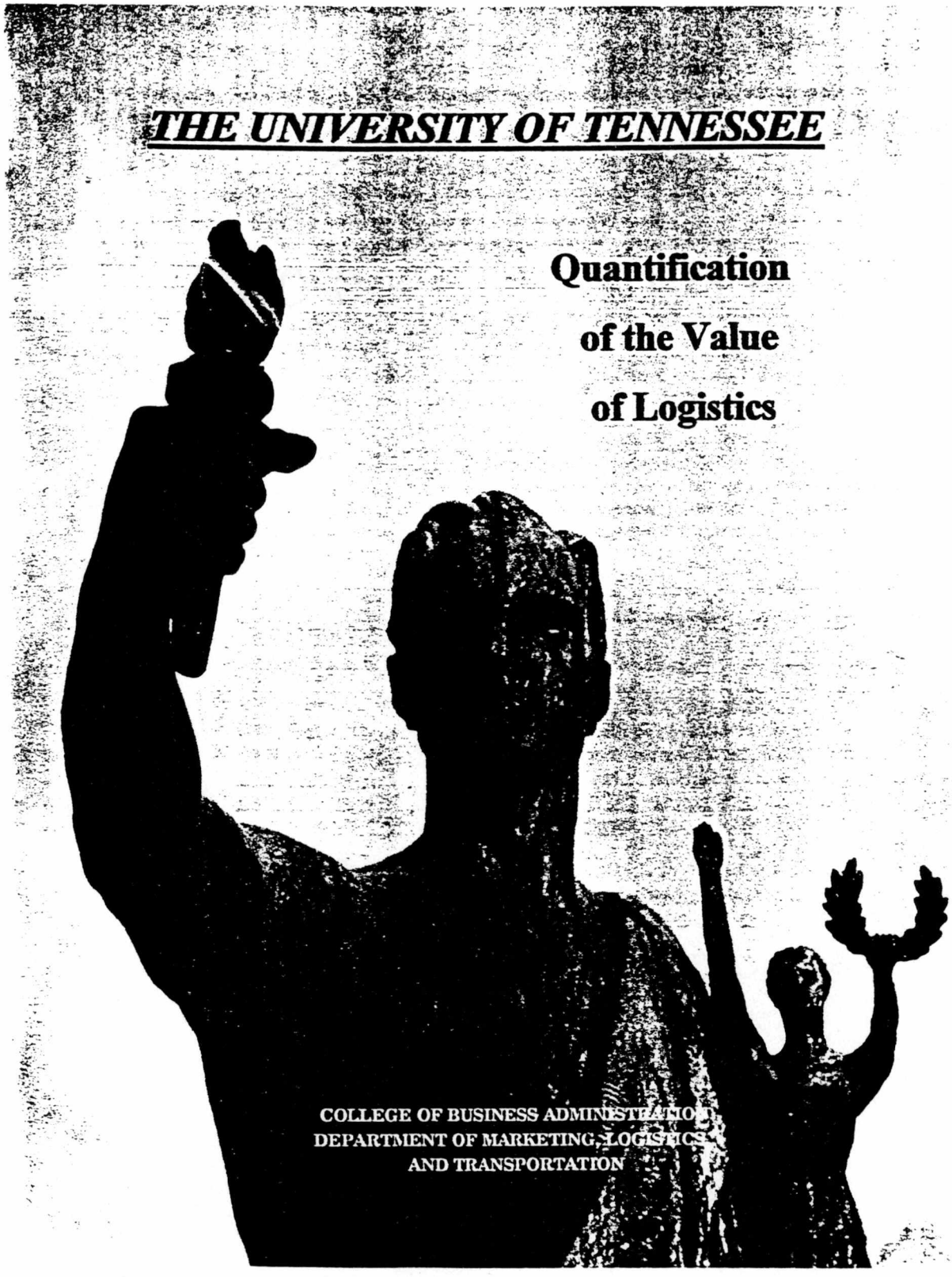
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Appendix D - Follow-Up Dissertation (Individual) Mail Survey


THE UNIVERSITY OF TENNESSEE
Quantification
of the Value
of Logistics
COLLEGE OF BUSINESS ADMINISTRATION
DEPARTMENT OF MARKETING, LOGISTICS
AND TRANSPORTATION

1. Does your company have a written definition or verbal understanding of "Value?"

_____ Yes, Written _____ Yes, Verbal _____ No

2. Please provide either your company's or your understanding of "Value" below.

_____

_____

_____

_____

3. Does your company differentiate between the terms "Value" and "Value-added?"

_____ No

_____ Yes, however only in definition terms

_____ Yes, by providing some "Value-added" services to customers

4. How does your company view Logistics?

_____ Core Competency _____ Competitive Advantage _____ Neither

5. Does your company view Logistics primarily as a cost center or a profit center?

_____ Cost Center _____ Profit Center

6. Which measurement techniques does your company employ to measure Logistics value? Circle all that apply. Please rate the amount of usage from 0=do not use to 1=Low to 4=Some to 7=High

	No	Low			Some			High
Return on Investment (ROI)	0	1	2	3	4	5	6	7
Complaints	0	1	2	3	4	5	6	7
Profitability	0	1	2	3	4	5	6	7
ABC Accounting	0	1	2	3	4	5	6	7
Order Cycle Time	0	1	2	3	4	5	6	7
Break-Even Analysis	0	1	2	3	4	5	6	7
Budget Variance	0	1	2	3	4	5	6	7
Inventory Turns	0	1	2	3	4	5	6	7
Return on Assets (ROA)	0	1	2	3	4	5	6	7
Line Fill Rate	0	1	2	3	4	5	6	7
Order Fill Rate	0	1	2	3	4	5	6	7
Product Availability	0	1	2	3	4	5	6	7

7. How long has your company been involved in the process of quantifying logistics value?

_____ years

8. How often does your company assess its Logistics performance using these measurement techniques. NA=Not Applicable, D=Daily, W=Weekly, M=Monthly, Q=Quarterly, S=Semi-annually, A=Annually, or NP=Beginning of a New Project.

	How Often							
Return on Investment (ROI)	NA	D	W	M	Q	S	A	NP
Complaints	NA	D	W	M	Q	S	A	NP
Profitability	NA	D	W	M	Q	S	A	NP
ABC Accounting	NA	D	W	M	Q	S	A	NP
Order Cycle Time	NA	D	W	M	Q	S	A	NP
Break-Even Analysis	NA	D	W	M	Q	S	A	NP
Budget Variance	NA	D	W	M	Q	S	A	NP
Inventory Turns	NA	D	W	M	Q	S	A	NP
Return on Assets (ROA)	NA	D	W	M	Q	S	A	NP
Line Fill Rate	NA	D	W	M	Q	S	A	NP
Order Fill Rate	NA	D	W	M	Q	S	A	NP
Product Availability	NA	D	W	M	Q	S	A	NP

9. Please indicate the order in which your company has or will implement the following techniques to measure logistics value: 1,2,3...12. Use NA for those techniques your company will not employ. Also, please indicate the extent to which each technique is used. Please distribute 100 points among the techniques in the Weight column. If all are used equally, each would receive 8 1/3 points.

	Order	Weight
Return on Investment (ROI)		
Complaints		
Profitability		
ABC Accounting		
Order Cycle Time		
Break-Even Analysis		
Budget Variance		
Inventory Turns		
Return on Assets (ROA)		
Line Fill Rate		
Order Fill Rate		
Product Availability		
TOTALS	NA	100

10. What or who was the driving force that began the logistics value quantification process? (Select all that apply)

_____ Internal Champion: (Circle One) CEO CFO COO VP Logistics Mgr. Other:_____
_____ Major competitor began measuring their logistics value
_____ Current literature and trade journals created interest
_____ Implementation of another program (TQM, ABC, ISO9000, etc.) led to the quantification
_____ Current cost reduction drive within your company
_____ Attempting to justify the logistics department's funding at budget time
_____ There was/is no driving force

11. Who has the primary responsibility for quantifying the value of logistics within your company?

_____ Logistic Dept.	_____ Accounting Dept.	_____ CFO
_____ Budget Team	_____ VP level	_____ Operations Dept.
_____ Other	_____ Equal combination of above	

12. Which of the following measures do you feel could be used by another company (Easily Transferred) or which are unique to measuring value in your organization (Organization Specific)?

	Easily Transferred				Organization Specific		
Return on Investment (ROI)	1	2	3	4	5	6	7
Complaints	1	2	3	4	5	6	7
Profitability	1	2	3	4	5	6	7
ABC Accounting	1	2	3	4	5	6	7
Order Cycle Time	1	2	3	4	5	6	7
Break-Even Analysis	1	2	3	4	5	6	7
Budget Variance	1	2	3	4	5	6	7
Inventory Turns	1	2	3	4	5	6	7
Return on Assets (ROA)	1	2	3	4	5	6	7
Line Fill Rate	1	2	3	4	5	6	7
Order Fill Rate	1	2	3	4	5	6	7
Product Availability	1	2	3	4	5	6	7

13. Which of the following functions are performed by your logistics department? If your logistics department performs that function, does it measure value, cost and/or operational performance? Please circle.

	Log Performs		Measures (Circle all)		
Outbound Transportation	Yes	No	Value	Cost	OpsPerf
Distribution Administration	Yes	No	Value	Cost	OpsPerf
Intracompany Transportation	Yes	No	Value	Cost	OpsPerf
Distribution Control	Yes	No	Value	Cost	OpsPerf
Field Warehousing	Yes	No	Value	Cost	OpsPerf
Distribution Systems Planning	Yes	No	Value	Cost	OpsPerf
Order Processing	Yes	No	Value	Cost	OpsPerf
Customer Service	Yes	No	Value	Cost	OpsPerf
Plant Warehousing	Yes	No	Value	Cost	OpsPerf
Inventory Management	Yes	No	Value	Cost	OpsPerf
Distribution Engineering	Yes	No	Value	Cost	OpsPerf
Production Planning	Yes	No	Value	Cost	OpsPerf
Sourcing/Purchasing	Yes	No	Value	Cost	OpsPerf
Raw Material/WIP Inventory	Yes	No	Value	Cost	OpsPerf
Sales Forecasting	Yes	No	Value	Cost	OpsPerf

THANK YOU FOR YOUR TIME AND EFFORT IN COMPLETING THIS SURVEY!!
Please return the survey in either the enclosed envelope or fax it to UT at (615)974-1932

Appendix E - Case Study Abstracts

Becton Dickinson & Company

L. L. Bean

National Semiconductor

Welch's

Becton Dickinson & Company
Case Study

Interview Date:

May 9, 1994

Location:

Becton Dickinson & Company, Franklin Lakes, New Jersey

Participants:

Mr. Henry B. Smith, III, President, Corporate Marketing Division
Mr. Nicholas J. LaHowchic, Vice President, Corporate Logistics
Mr. Naz Bhimji, Vice President, Corporate Service Product Systems
Mr. David C. Paul, Finance Manager, Supply Chain Management Group
Dr. C. John Langley, Professor
Dr. Lloyd Rinehart, Professor
Dr. Robert Novack, Professor
Mr. Stephen M. Rutner, Research Assistant
Mrs. Linda Miller, Research Assistant

Background:

Becton Dickinson (BD) is one of the world's largest medical technology companies. It was number 196 on the Fortune 500 in 1992. The company's annual sales were approximately $2.5 billion for fiscal year 1993. BD has 85 facilities in over 70 countries while employing over 19,000 people. The company's international sales accounted for 44% of total revenues in the last year.

Its business focuses in two major areas: medical supplies/devices and diagnostic systems. BD is the world's largest supplier of disposable hypodermic products. It works in the area of diagnostic systems with emphasis on "real time" testing, advanced cellular

analysis and tissue culture labware. The company spends over 5% of revenues or $139 million in research and development of new products.

Logistics' Key Area:

BD recognized its role as a channel captain. Based on that position, the company decided to enhance it market leadership by improving its logistics system. The company committed to employing a total supply chain management network. BD identified that logistics was an area that could provide additional value to its business.

The company is attempting to reduce its costs internally and externally. It has had limited success in quantifying the value of the improved logistics system. However, the executives strongly believe that there have been significant improvements both in terms of revenue and customer satisfaction. Most of the "value" is qualitative at this point. Regardless, BD has determined that logistics is providing value to the company beyond the traditional time and place utility measurements.

General Logistics Strategy:

The company has a top down driven approach to implementing the logistics strategy. With only one exception, the system is a very centralized planned network. However, outside relationships are not "forced" by BD's channel power. In fact, the customers drove the changes by requesting that they deal only with "one BD." Previously, it was not uncommon to deal with two or three different divisions of BD. So, the

company works with its customers to create individual plans to meet needs and present "one BD." There are three levels of tools that the BD mixes and matches for the users. These levels also indicate the level of partnership between BD and certain customers.

The company followed the process of some the other case study companies. It had a team approach to the overall evaluation of the logistics areas. It included a president from the marketing area, a vice president from the information technology group as well as a financial manager. It also reported having multidiciplined teams at lower levels that perform most of the operations. These teams represented the direct contact teams that create the customized response for the customers.

Quantifying the Value:

BD has had limited success with the quantification. They believe that the implementation of the three level system has created value. Most of the developmental costs were identified to create a new Level III custom solution for a customer. However, there was not an understanding of the costs before the project is begun. The Level I items costs were clearly known by BD from previous iterations. Although the costs may be known, the added value has not been quantified by either BD or its customers.

BD was attempting to create a model to capture the value created by these logistical changes. The process was complicated by the individualized nature of the programs. An example was one distribution center which required that its measurement driver be the reduction in SKUs. The resulting reduction of 50% of SKUs delighted the

customer, but the quantification was complex. BD was working on these problems by employing ABC.

Quantification Process:

BD had started their quantification process with the cost area. They were attempting to identify the costs involved with various logistics solutions. The company could quantify the cost of most of the different levels of services (although after the fact with Level III). BD then went to the customer and attempts to created a relationship and share the savings throughout the channel. This second portion was where BD was having trouble. They were unable to put hard numbers to the value that was created.

They identified a number of qualitative benefits from the logistical changes. One benefit was that the satisfied customers were "easier to do business with (sic)." Also, the process itself had increased the company's knowledge of their customers. This included a better understanding of the customers' desires and needs. Finally, the new order entry system had "improved the quality of life of employees" (BD and customers). The company was planning to conduct some form of survey to attempt to measure these areas. However, there were no details provided and it did not appear to be of critical importance to the company. BD implied that it would be included in their annual survey of customers.

Closing Comments:

BD provides an example of a good company that was making progress towards "leading edge" status. However, BD did not provide real examples of innovation. It did do many things well that can be used to confirm trends with other case studies. These trends are summarized:

- Use of teams to create the logistical system (marketing, finance and info tech);
- Centralized planning and decentralized operations;
- Establishment of supply chain management;
- Focus on logistics costs first and value second;
- Identification of qualitative logistics operations;
- Reliance on computer technology (EDI, etc.) to improve communications;
- Increase in partnerships and relationships;
- Views ABC as part of the quantifying solution;
- Set of tools (Toolbox) that are applied to various problems; and
- Support from highest levels of management (CEO).

BD believed and practiced the concept of competitive advantage through logistic superiority. The company was attempting to maintain its market leadership position and satisfy their customers' demands. They had taken a logical path in attempting to identify the value, and have made many of the initial steps.

L. L. Bean
Case Study

Interview Date:

July 21, 1994

Location:

L. L. Bean, Freeport, Maine

Participants:

Mr. Frank Johnson, Manager - Distribution Operations
Ms. Diane F. Bilodeau, Manager - Distribution Finance
Mr. Craig H. Rendall - Distribution Center Analyst
Ms. Joan Kuzmitski, Manger of Receiving and Quality Assurance
Dr. C. John Langley, Professor
Dr. Lloyd Rinehart, Professor
Dr. Robert Novack, Professor
Dr. Mary Holcomb, Professor
Mr. Stephen M. Rutner, Research Assistant
Mrs. Linda Miller, Research Assistant

Background:

L. L. Bean (LLB) is a world famous mail-order company based in Maine. Mr. L. L. Bean began the company by selling boots with a "100% guarantee or your money back" philosophy. Of his first 100 boots sold, 97 were returned. From that inauspicious begin, LLB has grown into a company with annual sales of over $850 million.

The company has experienced double digit growth for the last thirty years. They currently mail over 130 million catalogs yearly world wide. Last year they shipped product to every country in the world except North Korea and Cuba. There most recent

expansion is in the retail business. LLB currently has retail stores not only in Maine, but also Kobi, Japan.

Logistics' Key Area:

LLB has evolved from a manufacturing and mail-order company to a distribution company. The vast majority of their SKUs are manufactured by other companies. LLB acts a distribution center for most of their products. LLB recognizes that their logistics abilities are the key tools to business success. Their early adoption to a centralized ordering/inventory management system created a competitive advantage over their competition for almost five years.

LLB is not facing any imminent problems. The company is attempting to use logistics as a method to regain their previous position of the "leading edge" logistics company. The recognize that LLB requires a dramatic or break through advance to create another competitive advantage. They built a return center, reorganized the distribution center, opened an overseas facility and added product services in an attempt to improve their position.

Logistics Strategy:

LLB's first major strategy is the use of the third party provider to increase efficiencies. Fedex's Business Logistics Systems was selected to improve the outbound portion of the supply channel. BLS was moved into LLB's site and controls nearly all

outbound shipments. The goal is to reduce transit time and variation, while minimizing LLB's operational involvement.

The second major logistic strategy was the opening of the Kobi, Japan distribution center. This was delayed due to the earthquake. However, the goal is to reduce the overseas distribution costs to the Far East. LLB plans to expand its overseas operations from the Kobi location.

The final key logistics strategy was the inclusion of form utility in the distribution center. LLB began to monogram customer orders at the distribution center. The strategy is to provide an extra service to customers and create new business. The logistics operation performing this form utility represents a growing trend of creating non traditional value with logistics.

Quantifying the Value:

LLB had some success to measure the logistics value. They used some of the financial tools to determine profits and value. Unfortunately, LLB requested that the specific list of the tools that they employed not be disclosed. However, the overall system was similar to other case study companies.

The second area of measurement was based on the speed of the response to a customer's order. They had found a method to measure a elasticity based on time instead of cost. This was especially important in their decision to outsource to BLS. Again, LLB refused to allow any specific details.

The final two measures were very simple. LLB had identified that the additional revenues generated by using BLS outweighed extra costs. Also, LLB was able to measure the costs of poor quality very accurately. They had converted that into an estimation of value.

Quantification Process:

Due to LLB's restrictions on information, this section contains only the most general of comments. LLB's goal was to improve their overall process to maintain or regain competitive advantage in their industry. They were attempting to develop and measure techniques to accomplish their goals.

Closing Comments:

LLB was very similar to the other companies. However, they refused to allow any information to be published that was not already common knowledge. However, LLB did reconfirm other important points:

- Case by case implementation of the process to gain advantage;
- Increased implementation of information technology in logistics, very early adapter of information through to the end user;
- Use of logistics to gain competitive advantage;
- Focus on outbound with limited measurement work on inbound;
- Centralized planning;

- Support from highest level from CEO Leon Gorman;
- Identification of costs first and value second; and,
- Time is critical because of customer sensitivity:

LLB has long been viewed as a leader in logistics. This was true as well for the quantification of logistics. The company had made progress in examining its goals as well as its measurement techniques. It was similar to other case study companies in a number of areas. As with the other companies, LLB had made significant progress in one ore two areas of quantification. At the same time, LLB still used very basic tools and techniques in most areas.

National Semiconductor
Case Study

Interview Date:

June 8, 1994

Location:

National Semiconductor, Santa Clara, California

Participants:

Mr. Kelvin Phillips, Director World Wide Logistics
Mr. Larry Stroud, Materials & Logistics Controller
Dr. C. John Langley, Professor
Mr. Stephen M. Rutner, Research Assistant

Background:

National Semiconductor (NS) is the fourth largest United States (11th world wide) semiconductor company. They produce a number of computer chips, but not CPUs. Its annual sales total more than two billion dollars. The company is international is production, sourcing, distribution, philosophy and sales.

The head quarters is located in Santa Clara, California. They operate wafer fabrication facilities in four states and two foreign countries. Their assembly testing occurs in five plants in four Pacific Rim countries. The logistics network is currently under revision. However, distribution centers are located in England, Japan, Hong Kong, California and Maine. In 1994, NS and Federal Express will open a centralized distribution center in the Singapore, Malaysia.

Logistics' Key Area:

NS identified logistics as one of the major areas within the company to reduce overall cycle times. The computer industry is characterized as an ever shrinking time market. Product and service lifecycles are growing shorter. NS determined that its cycle times had to be reduced to remain competitive.

At the same time, the company is attempting to reduce the costs and quantify the value of the improved logistics system. The plan includes outsourcing to third part logistics services as well as the manufacturing and testing. The goal of increased efficiency is coupled with the reduction on total system costs. NS must reduce costs overall, not just within the logistical system.

General Logistics Strategy:

The company followed the format of many of the other case study companies. It had a team approach to the overall evaluation of the logistics areas. It included a financial analyst (comptroller). It also had multidiciplined teams representing various functions within the company that report to the Operational Business Management Council (OBM). These teams have to justify the value, costs and investment requests to the OBM Council. This team approach was similar to the logistics based teams with participation of other functions.

Also, it mirrored other companies' approach of cost first. The company focused on the Return on Assets or Investment (ROA/ROI). NS's OBM Council required specific

returns on the initial costs. However, the company had some success at quantifying the return and value of the additional logistics services.

Quantifying the Value:

NS's logistics managers recognized that some of the requirements that would be placed on logistics would increase some costs. The construction on the new facility in the Philippines has a tremendous initial capital cost. The use of Federal Express' BLS is a premium priced service. These special services increase the service levels for the entire supply channel, but at the previously mentioned increased logistical costs.

The goal is to quantify the value of these additional services. The logistics group has to justify the additional expenses. The qualitative measures were sufficient for approval of some projects, but failed to capture the entire savings and value of these projects. This process was an outgrowth of the analysis of the Federal Express / Business Logistics Services evaluation. NS is in the process of applying the same methodology to other projects. However, the process was mostly an one person effort for the BLS partnership.

Quantification Process:

The controller for logistics attempted to quantify the value or savings of the third party logistics provider's benefits. He did a number of steps to evaluate the entire project. One step was the forecasting of the expected returns from a number of different areas.

The total cost concept was employed including areas of transportation, warehousing, etc. NS did a good job of quantifying the traditional measures.

The unique portion was the inclusion of special areas normally not quantified. Interviews were conducted within the company to attempt to evaluate the savings or value created by the use of the third party provider's services. NS created an area of logistics' value called "Non Plant Savings." This area included quantified areas: reduced planning, credit productivity, order matching, customer service, freight admin. benefits, order matching and reduced administrative errors.

The methodology for specific areas was based on a number of drivers. The interviews identified heuristic measures that are applied to identify the savings value. One example is customer service. It was calculated on basis of accounts receivable costs and order entry costs as a multiple of the total. Another area of benefit was achieved in the days of inventory reduction. The total system resulted in a seven day reduction of total inventory that was translated into a dollar savings. This cost was not quantified into a value for the customer, but remained a NS benefit.

Closing Comments:

NS has made some progress towards successful quantification of logistics' value. The company's relationship with BLS forced NS to identify the some value created by logistics. Also, they confirm many of the trends previously identified in other case studies:

- The use of a team to design the logistics process;

- Creation of a set of measures based on specific drivers;
- Case by case implementation of the process;
- Centralized planning and decentralized implementation;
- Support from high levels within NS;
- Identification of costs first and value second;
- Partnership drove the process;
- Focus on physical distribution with little work in materials management;
- Time used as a competitive weapon: and,
- Increased cooperation and use of third party firms.

NS is implementing many sound logistical decisions. It has made improvements in many areas beyond the quantification. This company is more advanced than Becton Dickinson and on par with Welch's, Nabisco, and P&G. It has one area that it is doing well (quantifying non plant savings), but has been unable to quantify the entire process.

Welch's
Case Study

Interview Date:

May 20, 1994

Location:

Welch's, Concord, Massachusetts

Participants:

Mr. Dee Biggs, Director of Logistics
Mr. William J. Coyne, Group Manager - Logistics Operations
Mr. Brian P. Rothenberger, Manager - Logistics Operations
Mr. Edmund W. Schuster, Manager - Logistics Planning
Dr. Robert Novack, Professor
Mr. Stephen M. Rutner, Research Assistant

Background:

Welch's is a well know company that produces a variety of grape based products. It is a premium product that commands a higher price than its competitors. It is a traditional company that is actually a farmer's co-op. It has a very traditional outlook and is very conservative in all business matters. Currently, only 10% of sales are international.

The head quarters is located in Concord, Mass. Their manufacturing plants are located across the country. The plants are positioned near the main grape growing regions in upper New York, western Michigan, and two in California. The company faces a difficult position of having most of its production and distribution facilities near the Canadian border. This presents problems supplying the southern portion of the country.

Logistics' Key Area:

Welch's faced raising costs, slow growth and increased competitive pressures throughout the last part of the 1980s. Private label brands are beginning to take market share. The company constantly referred to the problems of the cigarette industry and private label price undercutting. Welch's is determined to reduce costs and pass some of the savings along to customers. Logistics provided one area to cut costs.

A second major problem was inventory stock outs. Because of limited shelf space in grocery stores, the slotting allowance and full utilization are a key item for the customer. Welch's reduced customer service levels to below 90% a few years ago and began to lose customers. The alternative of fill rates of 99.3% (recent level) was "too high." It created too much inventory throughout the system.

Logistics Strategy:

Welch's took a different approach to their logistics strategy. The company began a reengineering project in 1992. They brought in an outside consulting company to evaluate the entire company as well as the logistics system. The key result of the consultant's report was that Welch's recognized that it needed to modify its logistics systems.

The company recognized that logistics was a significant cost of the total product. However, outside pressures were driving the changes to allow the products to remain competitive with their customers. Welch's was concerned that the "sweeter" and cheaper

competitor products appealed to the younger customer. The company viewed logistics as the key cost reduction tool to improve market share.

There were two major areas in which the company desired to improve logistics. The first was information technology. The consultants identified the out dated computer system that the company was using into the 1990s. Also, the second area for improvement was customer service promotions. Welch's determined there was value for the program because of the customers' increased sales.

Quantifying the Value:

Welch's has had limited success in quantifying its value. The first success was in the justification of capital investment. In many cases, Welch's customers are demanding specific services from Welch's. One example is the requirement to have CHEP pallets that will cost Welch's about $800,000 a year. The value is a yes/no choice of doing business with that customer or not. The quantification has been limited to the value of each point during negotiations. Another example is the implementation of Continuous Replenishment. The cost is the measurement of the value of the system.

A second area of logistics quantification success is the promotional value. The goal is to make the customer more profitable. Welch's defined value-add as something that "makes more money for (Welch's) customer." The best example is the Display Ready Pallets. These are end of aisle premixed displays prepared by Welch's that can be rolled right into customers' stores. Through point of sale data, Welch's has determined nearly a

300% increase in sales of products using these Display Ready Pallets. The costs are easy to determine. The value is shown is specific revenue returns.

Other areas are also addressed. Welch's identified that other services are available. These included activities such as cross docking, custom packs, special pallet configurations and backhaul management. However, these opportunities are not being emphasized due to the additional cost and the unknown returns.

Quantification Process:

Welch's process was very different than other companies. The outside pressures are driving the change. Welch's labeled itself as a follower. It conservative nature means that it is willing to lag in logistical services to reduce risk. Therefore, the quantification process began with the consultants view. This led to the identification of costs and upgrading of computer technology.

The cost focus was combined with the marketing perspective. Marketing meets customers' needs and logistics finds a method to be cost efficient. The costs are compared with the returns (Display Ready Pallets). Often this has been a simple yes/no to continued business. It is important that Welch's has not included a financial or accounting staffer within the logistics team as it did with information technology.

Closing Comments:

Welch's quantification progress is really limited to the one area of promotion. It has confirmed some other areas. Also, its lack of an accountant in the team clearly contributed to its lack of good numbers in some areas. It did reconfirm other important points:

- Increased implementation of information technology in logistics;
- Use of logistics to gain competitive advantage;
- Focus on outbound with little work on inbound (location of plants contributed);
- Case by case implementation of the process (beginning of test case);
- Centralized planning and decentralized operations;
- Support from high level at Welch's (not CEO, but one level down);
- Identification of costs first and value second;
- Outside pressures forced the change; and,
- Time is critical due to physical supply chain length:

Welch's is making safe investments to improve its logistics system. The outside pressures have forced a more efficient Welch's. The company has integrated some of the marketing and logistics areas in practice but not in organization. Welch's has one major contribution to the study; if the company continues to improve, it can remain a leading edge type of company in logistics.

Appendix F - Corporate and Logistics Profiles[155]

Coors Brewing Company

Crystal Brands, Incorported

Kaska Distributing Company

Nabisco, Incorporated

The Proctor & Gamble Company

Unisys Corporation

[155] Novack, Op. cit..

Coors Brewing Company

Corporate and Logistics Profile

Coors Brewing Company produces and markets a broad range of beer and malt beverages for the consumer market. In addition they produce a range of industrial support products used in their own operations. Coors products are produced and packaged at a limited number of locations in the United States. Those products are distributed through company and independent wholesale outlets which service retail stores offering the products to the consumer market on the North American continent. As a producer of a wide range of popular beverage products, Coors is committed to the efficient and effective implementation of logistics processes necessary to meet the strong consumer demand for its products.

The innovative nature of Coors operations and logistics involvement is based on the significant internal focus of managing processes. Significant emphasis is placed on designing and implementing systems which allow for "best case" cost effective systems for their operations. This emphasis includes operational efficiencies in plant and distribution center environments, supplier relationship efficiencies in the management and storage of materials for production and packaging purposes, and customer effectiveness systems which can assist with enhancement of product availability in the consumer market place.

Several specific characteristics of Coors initiatives contributed to the relevance of their involvement in this research. Coors strongly contributed to the specification of quantification of logistics activities identified in this research. Some of those contributions include:

- Coors found that significant inefficiencies were occurring in the utilization of their transportation equipment because of weight distribution constraints of the product when loaded on highway trailers. Optimization techniques were used to design more efficient loading sequences for product, which reduced the cost of reloading and fines levied by state highway authorities.

- Distribution center efficiencies were enhanced through industrial engineering applications which increased the utilization of elevators in the brewery finished goods warehouse. This reduced the investment and construction cost of adding additional elevator equipment

- Material product availability was enhanced through improved supplier relationships and increased utilization of warehouse facilities. The improved relationship allowed Coors to work more effectively with a supplier that needed storage capacity that Coors had available. This arrangement increased facility utilization and service to Coors, and reduced total logistics channel operating cost, that lead to improved relations between Coors and the supplier.

Crystal Brands, Incorporated

Corporate and Logistics Profile

Crystal Brands, Incorporated, produces high-quality sportswear for men and women that is marketed through department and specialty stores under such brand names as Gant, Salty Dog, and Izod. Active sportswear for men and women is marketed under the Izod Club, EP Pro and U.S. Open Labels and is sold through golf and tennis professional shops at clubs and resorts. Crystal Brands also produces and markets fine-quality costume jewelry under the trademarks Monet, Trifari, and Marvella. Factory outlet stores are operated under the names Gant and Izod. The company also licenses its brands to producers of other fine-quality merchandise such as watches, eyewear, men's tailored clothing, outerwear, dress furnishings, and sportswear.

Sportswear products are distributed throughout the United States from two distribution centers located in Reading, Pennsylvania. Monet, Trifari, and Marvella costume jewelry is distributed from a distribution center located in Pawtucket, Rhode Island. Some jewelry products intended for international markets are subsequently warehoused and redistributed from company facilities in The Netherlands and Puerto Rico.

Several characteristics of Crystal Brands lead to their desirability as a case study:

- The nature of the retail fashion industry dictates that the product be available on the store shelf in a timely manner. Crystal Brands is in the process of implementing quick response logistics programs with key retail customers to achieve this goal.

- By providing logistics value-adding activities, such as product ticketing, for some of its key customers, Crystal Brands has been able to increase its product exposure by fifty-two days at the retail level. This is anticipated to increase Crystal Brands revenues with these customers.

- Warehouse costing methodologies utilized by Crystal Brands are well developed. This allows the logistics organization to estimate the cost of value-adding programs for its customers.

- Crystal Brands logistics works closely with merchandising, marketing, sales, and sourcing on supporting existing product lines and introducing new products.

Kaska Distributing Company

Corporate and Logistics Profile

Kaska Distributing, founded in 1974, has developed into a full service wholesaler in the fast food industry. KD services over 1,100 fast food restaurants in an eight-state, upper Midwest area. Orders are picked and delivered from four distribution centers that average 60,000 square feet of dry, refrigerated, and frozen storage. KD's 450 employees pick and deliver products over 85,000 times every year. Delivery of these products is accomplished by KD's private fleet, which averages 3.6 million miles per year.

Several characteristics of KD's operations made it a viable case study for this research:

- KD has established a very close relationship with its single customer. This customer owns or franchises all of the restaurants serviced by KD.
- KD has developed a comprehensive customer satisfaction survey that is administered to address the importance and performance of twenty-five attributes.
- The data collected from the survey are analyzed to identify gaps where improvement is to be made by KD in its operations. Sophisticated statistical and graphical representations of the data are generated to determine customer preference trends.
- KD has established EDI linkages with many of its customer restaurants to reduce transactions costs, increase logistics effectiveness, and improve overall customer service.
- Developing strategic relationships with many of its customer restaurants has allowed KD to continue to grow its business. KD believes that using the data from the survey to improve customer satisfaction has increased its revenues.

Nabisco, Incorporated

Corporate and Logistics Profile

Nabisco Foods Group, and operating unit of RJR Nabisco, Inc., is one of the largest packaged food companies in the world. With annual sales of more than $6 billion, it manufactures and markets an unparalleled line of famous cookies, crackers, and assorted grocery products. Well-known brand names include Oreo, Chips Ahoy!, Premium, Fleischmann's, A.1., Planters, Lifesavers, Grey Poupon, and Milk-Bone.

Nabisco's strategy is to concentrate on its core brands, introduce strategic new brands and build on the strength of its many leading products. In North America, Nabisco competes in eighteen major food categories. The company has the leading share of eleven of these and is number two in six others.

Various themes were found to exist in Nabisco's Integrated Logistics Group that made it a relevant case study:

- They have developed a sophisticated and integrated information system that gathers customer order data and assists in the management of cash and product flows and information.
- The Integrated Logistics Group has embraced the intent of the ECR movement by establishing very close relationships with key customers and well as with core carriers.
- Part of this partnering effort relies on sharing relevant information between the partners. Nabisco's Integrated Logistics Group has taken liberal advantage of EDI technology to support this sharing effort.
- The Integrated Logistics Group has also been able to establish very close partnership relationships with internal customers. Manufacturing, sales/ marketing, and accounting/finance work very closely with the Integrated Logistics Group to support external customer requirements.
- Because of its extensive information system, the Integrated Logistics Group is able to capture and utilize various types of logistics cost and service metrics. With this data, they have been able to develop a sophisticated costing methodology that is able to relate logistics service failures to revenue losses and logistics cost reductions to profit increases.

The Procter & Gamble Company

Corporate and Logistics Profile

The Procter & Gamble Company (P&G) is a worldwide leader in the marketing, manufacture, and distribution of consumer products. Known for its product integrity and advertising visibility, P&G maintains operations in fifty-three countries and generated over $30 billion in revenues for its last fiscal year. P&G is the market share leader for products in many categories, including laundry and cleaning products, personal care products, and food and beverage products. This leadership position is based in part on P&G's statement of purpose: "We will provide products of superior quality and value that best fill the needs of the world's consumers."

For General Customer Services, which is the logistics arm of Product Supply at P&G, the challenge is also clear: "To make it possible and reasonable to produce and deliver our products in a manner that benefits the company and its customers and suppliers." This organization exhibited several traits that made it an attractive case study:

- P&G's commitment to the ECR movement has placed its logistics organization in the important role of integrating its operations with those of its customers and suppliers.
- This same focus on ECR implementation has allowed P&G to develop information systems that effectively manage both cash and product flows between itself and its customers.
- Their concept of Product Supply Market Managers epitomizes the "single point of contact" philosophy that is a recurring theme in the case study firms.
- P&G's logistics organization takes a "job shop" orientation with its key customers when designing logistics programs that offer value-added services such as cross-docking capabilities and store built pallets.
- P&G has been able to develop sophisticated costing methodologies that allows it to assess the impacts of its value-adding services on its customers' logistics operations costs. By improving customer value for P&G products, these logistics initiatives have helped increase market share for many P&G brands.

Unisys Corporation

Corporate and Logistics Profile

Unisys is one of the largest providers of information services, technology, and software in the world. It employs about 49,000 people and does business in some 100 countries. About 80 percent of Unisys revenue is derived from commercial information systems and services, with the remainder coming from electronic systems and services for the defense market. Slightly more than one-half of revenue is from business in the United States. The company customer base is focused on those that operate in transaction intense environments. These organizations include financial services companies, airlines, telecommunications companies, government agencies, and other commercial enterprises. Unisys growth has resulted from a strategy that focuses on building long- term relationships with its clients, helping them creatively use information and apply technology to improve service to their customers, enhance their competitive position in the marketplace, and increase their profitability.

This value-adding focus of the corporate strategy made Unisys logistics organization an attractive candidate for a case study. Its contributions include:

- Strong partnerships between the Unisys transportation group and its carriers on a worldwide basis. This has been the result of an intense carrier base rationalization program.
- A sophisticated carrier performance quality measurement system that utilizes statistical process control techniques and places emphasis on improvement in carrier service quality.
- A process to assess carrier satisfaction with the Unisys transportation group. Unisys sees itself as a customer to its carriers because of its close working relationships with these organizations.
- The ability to develop and implement time-sensitive value-adding logistics activities for its key customers. These activities have proved to be a competitive advantage for Unisys and its logistics organization.
- A sophisticated transportation costing methodology that focuses on the total cost of transportation, including inventory costs.

Appendix G - Federal Express Business Logistics Services: Logistics Financial Impact Workbook Summary

Federal Express' Workbook is a sixteen page document used by their Marketing Department. It presents an analysis of the potential customer's logistics costs. It further identifies the possible financial and operational benefits available by switching to Federal Express' service.

The booklet's layout is similar to a tax form. First, the company determines its current situation. Then a company works through a number of subsections. These subtotals are aggregated to identify the total logistics impact on the income statement. This process is then repeated to determine any changes from employing Federal Express' services.

A key point of the booklet is that unit of measure. All of the logistics measures are quantified in dollar terms. The majority are based on the logistics costs involved. There are a number that examine other financial aspects:

- net profit
- current ratio
- quick ratio
- return on assets employed
- return on sales
- return on equity

- inventory as a percentage of sales
- revenue per employee
- cost as a percentage of sales
- logistics as a percentage of total cost.

These measures not only include cost, but identify the profitability of logistics actions. The workbook attempts to identify the value of employing Federal Express' logistical expertise and services. However, it provides an example of a quantification process of the value of logistics.

Federal Express holds the workbook copyright. For more information or a copy, contact Federal Express's Marketing Department, 2655 Dividend, Suite 101, Memphis, Tennessee, 38132.

Appendix H - Research Question #2 Responses

Dissertation Survey Question Number 2:
Please provide either your company's or your understanding of "Value" below.

Note: all responses were typed verbatim and contain numerous grammatical errors.

Providing the right product at the right price, time and place, without error, with consistency over time. 402

Overall effectiveness that a process provides. Includes cost, technology, distribution. Does it reduce cost, improve quality, customer satisfaction. 82

Greatest return on every dollar spent. 354

As it pertains to our merchandise we sell, it is expressed as "getting your money's worth." As an organization, it is a commitment to serving the owners, customers, community and each other. 740

The ability to provide a benefit to our customers which they could not obtain at a similar level or for the same cost. We would like to think the value we provide gives them a competitive advantage. 317

A fair return for the consumer dollar. What the consumer is willing to pay for. 692

Who is important, determined by our customer. 499

Meeting customers' expectation and company profitability requirements. 237

Something of worth to another entity for which they are willing to pay a premium to capture the use of or receive. 679

Shipping customers orders complete within three days of release. 829

Both a quantifiable and subjective perception of net worth for an item, process or organization in relationship to customers satisfaction. 967

Quality is defined as the value delivered to the customer. The components of value are the customer's perception of physical product, service and cost. 748

The creation of a business experience which exceeds customer requirements and expectations, in such a way that; it will not only be repeated by the customer, it will be shared throughout the business community. 37

1) Improvement in time and place utility. 2) Reduction in cost. 3) Improvement in product presentation. 1266

Delivering what a customer ordered on time, complete and with no damage. 322

Giving our customers and consumers what they are looking for. 799

Company's understanding of value would be to produce only "quality." 1400

What product/service do we receive for $ spent? What is that in relation to other options choices?
Value added - what no cost differentiation is there (service) between options: 2 red widgets at vendor or 2 blue widgets "delivered to plant". 639

"Value" is a term that must be first defined by the customer - internal or external. Our goal is to provide this value as defined by our customers effectively while not detracting from margins, but ultimately, improving them by gaining a competitive advantage. 705

Value is some attribute, service or product that the customer is either willing to pay for, increase or maintain purchasing level. 743

As an automotive distributor, "value" has the perception of the "worth" of the vehicle to the customer due to "price-quality-design & service". There is no understanding as to the "value" of logistics to the corporation except for the budget performance. 1362

Ability to provide product that meets or exceeds our customers' needs. Managing inventory assets, material flow and information flow, thus providing customers what they order, when they want it, at lowest total cost. 1401

Value is an added benefit/service provided to the end product, goods being marketed/sold. (For distributor, i.e. delivery of product, warehousing of product, etc.) 74

Exceptional customer service adds value to our products and existence. 865

Our overall goal in distribution is to lower our distribution cost per unit with the same or better service as last year, but do it faster, more efficiently and at the same or lower cost. 713

Product or service that a customer is willing to pay for. 1282

Fair return or worth of a product or service. 622

Consumers -- Provide consumers with an attractive array of quality products at stable prices they find reasonable and to have them available to purchase in a very large number of retail outlets.
Customers -- Be a decisive category leader with a product line that consumers want to buy. With knowledge and services that result in mutually profitable opportunities. 1555

A tangible (or intangible) entity under which a company can clearly demonstrate a worth of its products or services. 1184

Cost of utility. 1618

Value implies that if something isn't done, the omission will be noticeable in some way by the customer. 431

ROI & cost as % of sale. 94

Cost/perception relationships. 1291

Value = seven basic rights of the customer all done in harmony. 135

Value: What makes our products more important to a consumer vs. competition. What is it that provides that distinction? 594

We believe that by implementing and constantly improving our quality system, will enhance the value of our products made and shipped to its consuming customers. 465

Perception of worth. 1395

Dedication to overall product quality while striving to be the "low-cost" producer of our products. 587

Creating customer enthusiasm. Listening, learning and leading. 1522

It is a tangible assessment or attachment to a service or product provided to a customer. Tangible implies quantifiability. 1450

The contribution to profitability, customer satisfaction and market penetration. 1200

The definition is currently not concrete but emerging (hopefully). Currently value is defined as providing quality and service to clients over and above expectations of accuracy - damage free - on time, etc. 1032

Positive competitive differentiation of logistic cost, service and /or quality. 1237

Economic value added is increase in economic profit over a specified period of time. 660

Value = ration of functionality to price. Functionality = flexibility, willingness to share info, leadership, position, etc. 20

A. How much are you willing to pay. B. A fair return on investment. 194

Value is used as it relates to the shareholder. We use the EVA (Economic Value Added) method to incent managers. EVA is driven Economic Profit. Economic Profit is the profit after taxes in excess of invested capital X the cost of the capital. The change in Economic Profit from year to year is EVA. 774

Providing a product or service at a price with expectations that are promised and expected. 443

Worth or to rate at a certain price. 684

Maximum utilization of logistics assets in meeting or exceeding corporate goals. 2

In 1989 our corporation created a business approach the wholly marketed logistics and operations as our strategic weapon and continued today as the premier (and most frequently benchmarked) program in our industry. We created value by driving all relevant business costs out of the supplier/customer relationship. 345

We use a term "value-for-money" meaning that we weigh both the quality and cost of a particular situation (i.e. the services that we buy has to create value for money). 1393

Best value is a combination of quality, price, service to provide the customer what he wants when he wants it. 1050

Providing customers expectations. 1494

That which meets or exceeds the needs of internal & external customers. 1289

Costs and/or savings related to a specific task. 945

Increasing the payback to the company via revenue growth, asset reduction, cost reduction or customer satisfaction. 316

The intrinsic worth of products or services from either a customer or supplier perspective. 762

Providing information and services to enhance our customers effectiveness beyond traditional product support. 981

Value is something a shareholder would be willing to pay for. 1000

Best combination of product quality, price, service and risk. 1145

Provide a service or product which has utility in a customers business or personal life. 569

Benefit, principle or conviction that has fundamental worth to people. 729

Value is all relative to your needs. A high priced item does not mean it has greater value to a organization. We measure the items need first and its value second. 1208

In the company "value" is a financial concept but also a competitive concept. The logistics functions add "value" by continually reducing cost but also reducing cycle time, entrance times and providing service to customers (ship dates, bar code, EDI, etc.). 890

Amount of revenue a customer will pay for product and/or service, less the cost to produce and provide it. 833

Provides worth or cost reduction. 653

Have the product available or to the customer when they want it. 550

My understanding or, rather, conception of value transcends actual monetary cost. I believe an "items" value is truly tied to the benefit. 867

As members of the Grocery Products Division, we will produce and deliver on time, defect free products and services that meet our customers' requirements the first time, every time. 538

Performing a function that the customer will pay for. 598

Part of mission statement for logistics network. Value statements of cost, safety, service and asset utilization are included. Value statements are quantified into performance indicators. 1155

Serving our customers more effectively than anyone else. 1179

Value is a product or service that is priced in such a manner that it is perceived to be desirable. 570

Process or activity that creates direct benefit to the customer. 1252

The contribution made as a part is transformed from raw material to a finished product. 787

Getting what you expect for the amount of output. 1019

Customer services outperform competition. Distribution can be a profit center, not the black hole of your corporation. My distribution centers are the show place, first stop on every tour. Ownership pride. 1552

Value = Quality product or service at a reasonable price, and profit for all parties involved. 1008

We wish to receive a fair price for the goods and services supplied our customers. 999

Integrity, trust, communication, teamwork, innovation, responsiveness, citizenship are all components of company value statement. 478

A contributing factor or additional benefit, whether tangible or intangible that can impact a decision or process. 677

The logistics value concept incorporates a planning and execution function for the customer "booked order" business and the forecasted order business. Quotation product estimating backlog is reviewed to execute positive performance to plan. Specific numerical targets are published in business plan that support value goal. 34

What me adds to a work process. 495

Relative to added value distribution whereby product moves throughout distribution facility and value is added through kitting, special packaging requirements, ASN, EDI, bar-coding of product. 1318

Lowest cost provider of quality service to our customers. 274

Vita

Stephen Martin Rutner was born on August 14, 1963. He grew up in South Florida and graduated from Riverside Military Academy in May 1981. Following high school, he attended Millersville University of Pennsylvania. He received a degree of Bachelor of Art as a History major in May 1987.

After graduation, he was commissioned as a Second Lieutenant in the United States Army. As an armor officer, he served at Fort Knox, Kentucky and Fort Stewart, Georgia. He still serves as a Captain in the Alabama National Guard.

In the fall of 1990, he enrolled at the University of Alabama. In May 1992, he earned a Master of Business Administration. His area of concentration was Marketing and Logistics.

Steve entered the University of Tennessee during the fall of 1992. While working on numerous projects, he completed his classes and dissertation. He received a Doctor of Philosophy degree majoring in Business Administration. His major area was Logistics and Transportation with support areas of Operations Management and Marketing.

He hopes to pursue a career in academia. His goal is to obtain a position with a major university as an assistant professor. He is currently working as the Director of Undergraduate Advising for Logistics and Transportation. His research interests include logistics value, strategic alliances, intermodal transportation and airport landside transportation.