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AN ANALYSIS OF FREIGHT FORWARDER OPERATIONS
IN AN INTERNATIONAL DISTRIBUTION CHANNEL

DISSERTATION

Presented in Partial Fullment of the Requirements for
the Degree of Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Frederick W. Westfall, B.A., M.S.

* * * * *

The Ohio State University

1987

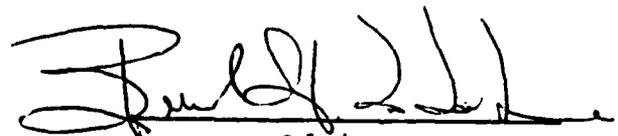
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To My Family
Jan, Jennifer and Bill

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Many people made it possible for me to complete this research. I thank my wife for her extra efforts, untiring patience, encouragement and support throughout this whole period. My children, Jennifer and Bill, not only survived my absences but have grown into caring, sensitive adults. A special thanks is due them for their understanding and support.

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AN ANALYSIS OF FREIGHT FORWARDER OPERATIONS
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By

Frederick W. Westfall, Ph.D.

The Ohio State University, 1987

Professor, Bernard J. LaLonde, Advisor

The United States Air Force supports weapons systems sold worldwide through the Security Assistance Program. The channel of distribution to deliver the material consists of the Air Force or a contractor in the United States, a commercial freight forwarder, and the recipient country. When material is lost somewhere in the distribution channel, the mission capability of the U.S. Air Force and the foreign air force may be impaired. In many instances, the U.S. Air Force must pay the replacement costs for items lost in shipment. The freight forwarder, who provides a variety of services, is the international distribution channel link and is contractually bound to the foreign government.

This research examines the effectiveness of services the freight forwarders provide their customer, the foreign country. Fifteen variables were tested to determine their relationship with the amount of material lost in the distribution channel. It was found that no single variable could establish such a relationship. Principal component factor analysis was used to form new groups from the fifteen original variables. When the

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CHAPTER I
INTRODUCTION

Introduction

The future economic survivability of any nation may well depend upon the actions it takes today to be more competitive in the world marketplace. Most scholars of international trade acknowledge that the economies of individual nations are becoming ever more interdependent and competitive. Mr. B. C. Christensen, Vice President and General Manager of International Business Machines World Trade Corporation, recently expressed his concern about the United States' declining competitive position in the world marketplace. He noted that declining productivity over the past 30 years has brought about the need for the United States to find innovative ways to increase or at least maintain its share of the global market.¹

While in absolute terms the United States remains the largest exporter and importer in world trade, its relative importance and position as a leading world trading partner has diminished. In 1950, for example, the United States imported 16 per cent of all world imports while enjoying a 17.8 per cent share of all world exports. By 1981, in contrast, the United States' share of imports was

14.3 per cent but its share of world exports had dwindled to only 12.7 per cent.²

Table 1 lists the import and export statistics for the United States for the period 1960 through 1982. It shows clearly that the United States has consistently imported more than it has exported for that time period. Further, the figure shows that this trend is increasing. In fact, the United States ended 1983 with an all-time trade deficit of over 69 billion dollars! This trend seems to be growing at an increasing rate since at the end of the first quarter of 1984, the trade deficit exceeds 25 billion dollars. This continuing deficit position has resulted in a highly volatile and undesirable situation which adversely affects the United States' Balance of Payments accounts and can ultimately affect our national economic health.

What is needed is a solution to increase the amount of our exports, decrease the amount of goods imported, or a combination of both. An increase of only one percent of world exports equates to approximately two billion dollars in revenue to the United States. Although there are no guaranteed solutions to enhance the United States' worldwide competitive position, political hopefuls and special interest groups have offered abundant recommendations.

Ideas ranging from import quotas to the "content" laws to raising tariffs on certain items to voluntary export restraints by our major trading partners have all been

TABLE 1

UNITED STATES IMPORTS AND EXPORTS

<u>YEAR</u>	<u>IMPORTS</u>	<u>EXPORTS</u>	<u>NET</u>
1982	254.884	212.276	- 42.608
1981	273.352	233.739	- 39.613
1980	256.984	220.786	- 36.198
1979	222.228	182.025	- 40.203
1978	186.045	143.766	- 42.279
1977	160.411	121.232	- 39.179
1976	132.498	115.413	- 17.085
1975	105.880	108.112	+ 2.232
1974	110.875	98.552	- 12.323
1973	74.280	71.404	- 2.876
1972	59.328	49.783	- 9.545
1971	48.755	44.156	- 4.599
1970	42.675	43.241	+ 0.566
1969	38.498	38.032	- 0.466
1968	35.438	34.667	- 0.771
1967	28.819	31.640	+ 2.821
1966	27.791	30.434	+ 2.643
1965	23.233	27.530	+ 4.297
1964	20.334	26.650	+ 6.316
1963	18.640	23.387	+ 4.747

SOURCE: International Financial Statistics, International Monetary Fund, Vol XXXVII, #2, Feb 1984, pp. 67-68 and the Supplement on Trade Statistics, No. 4, pp. 118-131.
 Amounts shown are in Billions of United States Dollars using a base of 1975.

offered as solutions. Unfortunately, these suggestions pertain only to imports and usually result in an increased cost to consumers.³ Further, these "protectionist" measures are usually considered short term remedies to a problem which needs a long term solution.⁴ For an effective long term solution, the United States requires a way for its manufactured products to be more competitive in the global marketplace thus increasing the United States' share of world exports.

Mr. William S. Anderson, Chairman of the Executive Committee at National Cash Register Company, recently stated his views on how to be more competitive in the global marketplace. His plan suggested that to improve export marketing a firm must price competitively through: 1) producing a better product, 2) better distribution effectiveness, 3) lower costs, and 4) better total performance.⁵ The price the consumer pays for an item is ultimately derived from the interaction of variables in the marketing mix. Of those variables, the distribution functions seem to allow the greatest flexibility and the greatest area for process innovation.⁶ The distribution strategy, and specifically, the nature and type of the distribution channels used will affect total costs and thus the price of the product.⁷ Usually, when the price of a product is lowered, a corresponding reduction in product costs is necessary or at least highly desirable. A recent

survey⁸ of domestic firms has shown that over 8.5 per cent of the total cost of the item is attributed to distribution costs. When further analyzed, these data show that transportation of finished goods is responsible for greater than 38 per cent of these distribution costs. While there was no similar study done on firms doing business internationally, it should be safe to assume that the transportation and total distribution costs would represent a significantly larger percentage of total costs. Since these transportation and distribution costs are such a large portion of the total cost they are a most viable candidate for some type of reduction. In order to understand these distribution costs one must study the international distribution system and understand the peculiarities of that system when dealing in international trade.

For many companies, dealing in international trade is a relatively new mode of business operations and is therefore not fully understood. Without routinely dealing with international distribution, functions and interrelationships of channel members can be confusing. International freight forwarding operations seem to be especially irritating and frustrating for many who work in physical distribution. Research by LaLonde and Czinkota on the export activity of small and medium sized manufacturing firms, suggests that physical distribution can no longer be considered a "subordinate" activity of an exporting firm. Further, they

state that:

"...the potential for international competition may well rest to a large extent on improvements especially in the area of post-sale service. Firms must pay more attention to international logistics and focus on improvement possibilities in that area. In the long run the efficiency of physical distribution operations may mean the difference between success and failure."

They conclude that "...physical distribution factors are essential to the export offering of the firm, and thus need to receive commensurate attention."¹⁰ This concern for increased awareness of international distribution was evident at the 1983 National Council of Physical Distribution Management convention where Mr. Robert L. Vidrick chaired a subject track on International Physical Distribution. In his opening remarks at the session entitled "Selecting Your International Distribution Team", he stated that the freight forwarder was the undisputed "nemesis" of international distribution.¹¹ Yet, a recent study done by Distribution magazine¹² noted that a full 80 per cent of exporters surveyed used a freight forwarder that was not part of their own organization. Unfortunately, there is no mention of how the performance of these forwarders is evaluated. Without an evaluation, it must surely be difficult to identify the individual contribution and associated costs of distribution services the forwarders provide. While research done by Okefor has shown differences in the perceived importance of export

distribution services to differing export groups¹³, there has been little work done to identify the overall performance of specific freight forwarder export functions on distribution effectiveness within defined export channels of distribution.

There exists a need to examine the services offered by freight forwarders in order to identify which of those services provide the most effective channel of distribution. Since the deregulation of many carriers has been in effect, freight forwarder services have increased in both number and complexity of their operations.¹⁴ In order to ensure that a company is using these services in the most effective way, it is necessary to evaluate these services in terms of their contribution to the overall distribution effort as well as the total distribution cost.

Statement of the Problem

The primary purpose of this research is to determine which freight forwarder services provide the best measures for evaluating the effectiveness of independent members in an international channel of distribution. Specifically, this will involve an analysis of the freight forwarders within a defined international distribution channel. For a detailed description of the problems and channels to be studied in this research see Appendix C.

As previously stated, the large-scale deregulation of the transportation industry has allowed and prompted international freight forwarders to increase the number and complexity of services offered to exporters. However, as these services become available, exporters need to ensure that the use of such services adds to the overall effectiveness of their export effort. Inherent in overall effectiveness is the element of efficiency if profit maximization is a stated goal of a company's export operations.

Unfortunately, studies have shown that channels of distribution have evolved in order to satisfy a specific need and were not necessarily planned with either effectiveness or efficiency as criteria for decision making.¹⁵ Further, once channels have been established, they seldom change substantially from their basic

structure.¹⁶ The same study concludes that contrary to what might be expected, distribution channels are not managed¹⁷ in a systems perspective which means there is a great possibility for suboptimality within the organization.

In order to ensure the most effective distribution system possible, it is essential that each channel member perform its designated functions correctly and to the best of its ability. This requires that the channel be properly thought out in advance and managed once in operation. The consequences of not carefully planning the distribution channel include (1) increased promotional costs, (2) poor market coverage, (3) ineffective sales effort, (4) an imbalance of production and sales, and (5) slow or misdirected physical distribution of the company's products.¹⁸ While each of these is important and impact one another, it is the last consequence which is of primary interest in this research.

Background

There exists a striking corollary between the decline in U.S. commercial exports and worldwide sales of military equipment. While the U.S. share of worldwide commercial exports has declined only approximately 5 per cent over the last 30 years, the share of U.S. military equipment sales has declined more than five times that amount during a similar period. A recent study has shown that in less than a twenty year period, from 1963 to 1980, the United States'

share of worldwide arms sales has been reduced from 56.9 per cent to 30.8 per cent.¹⁹ The author provides several reasons for this trend, including (1) an increased number of weapons suppliers, (2) preference of less developed countries for less sophisticated weaponry, (3) increased defense production capabilities and trade between and among less developed countries, (4) country's desires for multiple suppliers for political motives, and (5) changes in scale economies based on comparative advantages, particularly costs.²⁰ While the author does not suggest a sole reason for the declining market share in military sales, she does contend that military sales may suffer from many of the same problems as the private sector when exporting. Such trends have important economic and national security implications for the United States.

The national defense of the United States is a vital area which is highly dependent upon effective distribution channels. The foundation of our national defense strategy is tied to our stated foreign policy. Former Secretary of State, Henry Kissinger, stated:

" Foreign policy must start with security. A nation's survival is at its first and ultimate responsibility; it cannot be compromised or put to risk. There can be no security for us or for others unless the strength of the free countries is in balance with that of potential adversaries, and no stability in power relationships is conceivable without America's active participation in world affairs."²¹

This balance of strength is partly achieved by arms sales from the United States to allied countries throughout the world. The distribution channels used for these military sales can impact severely on the defense posture of the United States.

Whether or not one's personal philosophy agrees with the sale of military equipment on a global basis, there are many sound economic and national defense reasons for such actions. Most of the arguments defended by proponents of commercial exports also apply to military sales. The United States gains in its balance of payments accounts for military sales. They help maintain a larger military-industrial production base because of increased demand for equipment and parts. This in turn adds jobs in the United States. Additionally, the taxpayer gains through reduced unit costs when foreign orders are added to domestic requirements for military equipment and supplies. Since much of this equipment is the same as the Department of Defense equipment, commonality of facilities and standardization of equipment can greatly enhance the readiness of our forces and reduce the amount of spare parts required for deployment to a friendly nation having like equipment.

On July 8, 1981, President Ronald Reagan announced the new "Conventional Arms Transfer Policy." In it, he stated that the transfer of conventional arms and other defense

articles was an essential element of our foreign policy and that when applied judiciously, arms transfers can "...help enhance United States defense production capabilities and efficiency."²² For a detailed explanation of the Security Assistance Program see Appendix B.

A typical export channel for commercial sales is made up of a manufacturer, a middleman who performs the functions of a consolidator or freight forwarder, and a foreign purchaser. International distribution channels for arms sales, just as for commercial sales, must operate at maximum effectiveness in order to ensure the United States becomes more competitive in the global marketplace. It is effectiveness in international channel management which is the primary area of concentration for this research.

Research Objectives

The primary objective of this research is to identify those services or combination of services performed by freight forwarders which produce the most effective channel of distribution. For purposes of this study, effectiveness will be measured as an index which is determined by the amount of material lost in shipment as part of the total amount shipped overseas in the distribution channel. This is consistent with the Air Force definition of effectiveness found in Compendium of Authenticated Systems and Logistics Terms, Definitions and Acronyms. That effectiveness measure

also is supported by studies performed on commercial distribution channels. As Lambert points out "almost two-thirds of the firms used damage or claims reports to measure the performance of common carriers."²³

Other measures used to measure performance include surveys of customers, cost reports, transit time, customer complaints, on-time delivery performance and carrier reliability.²⁴ However, for purposes of this research, the measurement of loss reported in the distribution system is considered the most reliable indicator. Whereas non-receipt (loss) of an item represents a complete loss of funds to a customer and therefore would in all likelihood be reported to the manufacturer for credit on their account, a misdirected shipment, i.e., a shipment ordered by customer A but received by customer B by mistake, represents a total gain by customer B and may not be reported by customer B. Similarly, shipments received in excess of the quantity ordered may not be reported if 1) the customer was charged for the lesser amount, or 2) the customer could use the larger amount at some time in the future and therefore chose to pay the additional cost, if any.

The specific objectives of this research are:

1. To establish the relationships between the types of information flows, data transmission and the amount of material lost in the specific distribution channel.

2. To establish the relationship among specific transportation functions provided by freight forwarders and the amount of material lost in the distribution channel.
3. To determine if a relationship exists between the origin, routing or destination of requisitions and the amount of material lost in a channel of distribution.
4. To determine the relationship between traffic volume (as measured by number of shipments) to customers and the amount of material lost in the distribution channel.

Scope of the Research

The area covered by this research includes international military freight forwarders who are contractually bound to foreign governments actively participating in the Security Assistance program with the United States Air Force. Also included in this group for consideration are military freight forwarders of foreign government sponsored (supported) organizations which provide some type of military service function to their government or do military contract work for other allied governments. Examples of these organizations are military repair facilities in Germany, Turkey, and Greece. They function as depot level repair facilities specializing in certain common

military components or hardware. The Department of Defense directives which govern military sales to friendly foreign nations also apply to these organizations and agencies.

Omitted from this study are those freight forwarders of other military service's (Army and Navy) programs. While they are governed by the same Defense Department directives, their procedures differ in several areas and therefore are not directly comparable for purposes of this research. It is recognized that a single forwarder may service United States Air Force and other service's material, however, this will be considered and analyzed as part of the hypothesis testing process (data for Hypotheses H4.2 and H10.2).

Research Hypotheses

Services provided by international freight forwarders vary for each distribution channel depending upon needs and desires of the channel members, the firm's motivation and strategy for export marketing, as well as product characteristics which the channel serves.²⁵ This research is primarily concerned with those purely logistical functions which provide time and place utility. The hypotheses were formed through an iterative process using a panel of experts and confirmed through a pretest questionnaire. The hypotheses formulation process is identified in Appendix D. Each hypothesis represents a logical relationship which was believed to be present in the distribution channel. The following research hypotheses

cover those essential distribution functions and relationships normally found in an international distribution channel.

The general theses are advanced, followed by the hypotheses stated in null form:

THESIS 1: The type of data transmission affects material loss.

H1.1: There are no significant differences in material loss between requisitions submitted by mail and those submitted by TELEX.

H1.2: There are no significant differences in material loss between requisitions submitted by TELEX and those submitted by Dataphone.

H1.3: There are no significant differences in material loss between requisitions submitted by Dataphone and those submitted by mail.

THESIS 2: The type of data information flow affects material loss.

H2.1: There are no significant differences in loss between information flows of Type 1 (customer-freight forwarder) and those of Type 2 (producer-freight forwarder-customer).

H2.2 There are no significant differences in material loss between information flows of Type 2 and those of Type 3 (producer-freight forwarder only).

H2.3: There are no significant differences in material loss between information flows of Type 1 and Type 3.

THESIS 3: The amount of inspection done by the freight forwarder affects material loss.

H3.1: There are no significant differences in material loss between freight forwarders performing less than 5 per cent inspection of all goods and freight forwarders performing more than 5 per cent inspection upon receipt of material at their operating location.

THESIS 4: The consolidation policy of the freight forwarder affects material loss.

H4.1: There are no significant differences in material loss in full consolidated shipments and individual shipments, i.e., those in less than full containers.

H4.2: There are no significant differences in material loss in consolidated shipments from a single producer and those shipments made of mixed (several producers') shipments.

H4.3: When shipments are consolidated, there are no significant differences in material loss between forwarder who provide a new Bill of Lading and forwarders who do not provide a new consolidated Bill of Lading to their customers.

THESIS 5: Shipment to more than one Port of Entry (POE) affects material loss.

H5.1: There are no significant differences in material loss between shipments to a single POE and shipments to multiple POE's.

THESIS 6: The type of carrier affects the amount of material loss.

H6.1: There are no significant differences in material loss between air and water carrier transportation.

H6.2: There are no significant differences in material loss between foreign flag carriers and United States flag carriers.

THESIS 7: The volume of traffic to a customer affects material loss.

H7.1: There is no significant relationship between material loss and dollar value.

H7.2: There is no significant relationship between material loss and the number of shipments.

H7.3: There are no significant differences in material loss between forwarders who have less than 20 per cent of their business with the U.S. Air Force and those with between 21 and 50 per cent of their business with the U.S. Air Force Security Assistance Program.

H7.4: There are no significant differences in material loss between forwarders who have between 21 and 50 per cent of their business with the U.S. Air Force and those with greater than 50 per cent.

H7.5: There are no significant differences in material loss between forwarders who have less than 20 per cent of their business with the U.S. Air Force and those with greater than 50 per cent of their business with the U.S. Air Force Security Assistance Program.

THESIS 8: The facilities provided by the freight forwarder affect material loss.

H8.1: There are no significant differences in material loss between full service and less-than-full-service freight forwarders.*

* forwarders will be categorized depending upon physical facility capabilities according to answers provided to the questionnaires.

THESIS 9: The presence of a customer representative in the United States affects material loss.

H9.1: There are no significant differences in material loss between customers who have a representative in the United States and those customers who do not have such representation.

THESIS 10: Performing as an exclusive freight forwarder affects material loss.

H10.1: There are no significant differences in material loss between freight forwarders handling only one customer and those serving multiple customers.

H10.2: There are no significant differences in material loss between freight forwarders handling only a single producer's material and those forwarders handling more than one producer's material.

THESIS 11: Flow times through the freight forwarder affects material loss.

H11.1: There are no significant differences in material loss between freight forwarders whose flow time is less than 5 days and those forwarders whose flow time is greater than 5 days.**

** the actual number of days to be the break point will be determined by average times obtained from questionnaire statistics.

THESIS 12: The economic development of a country affects material loss.

H12.1: There are no significant differences in material loss between developed countries and developing countries.***

***The category of any particular country will be determined from the definition and classification provided by the Organization for Economic Cooperation and Development (OECD).

Table 2 provides a summary of the hypotheses, sources for collection of data, and the statistical methods to be used.

Upon completion of the individual analysis of variance testing of each hypothesis, each variable will then be statistically tested using stepwise multiple regression techniques. The purpose of this test is to observe if a predictive model can be defined from the twelve previously identified variables (those from Theses 1 through 12). If there proves to be a statistical significance between or among the variables, a customer or producer could use the identified variables as a guideline for evaluation and

management of the freight forwarder in the existing distribution channel or as a base for establishing a new international distribution channel or individual channel members.

TABLE 2

SUMMARY OF HYPOTHESIS TESTING

<u>HYPOTHESIS</u>	<u>DATA SOURCE</u>	<u>STATISTICAL TEST</u>
1. Data Transmission	1,2,4	Analysis of Variance
2. Information Flow	1,2	Analysis of Variance
3. Inspection	1,2	Analysis of Variance
4. Consolidation Policy	1,2	Analysis of Variance
5. Multiple POE's	1,2,3	Analysis of Variance
6. Carrier Type	1,3	Analysis of Variance
7. Traffic Volume	3	Analysis of Variance and Regression
8. Facilities	1,2	Analysis of Variance
9. Customer Representative	4,5	Analysis of Variance
10. Exclusivity	1,2,3	Analysis of Variance
11. Flow Times	1,3	Analysis of Variance
12. Economic Development	6	Analysis of Variance
All (Hypotheses 1-12)	-	Multiple Regression (Stepwise Method)

Data Source: 1. Freight Forwarder Questionnaire/
Interview
2. Country Manager Interview
3. U.S. Air Force Reports
4. Customer Representative Interview
5. Personal Observation
6. Organization for Economic Cooperation
and Development (OECD)

Methodology

The methodology used for this research will consist of three phases. First, a questionnaire will be designed and sent or delivered to selected freight forwarders. Secondly, personal interviews will be conducted with the various customer representatives at Wright-Patterson Air Force Base, Ohio, who are intimately familiar with the customer's programs and the customer's freight forwarder. Finally, the information obtained from the freight forwarders and customer representatives will be tested using the hypotheses stated earlier in this chapter. Specific data collection procedures are explained in detail in Chapter III.

Hypothesis Testing

Once the data are collected and validated, they will be tested using the Statistical Package for the Social Sciences (SPSS) on the U.S. Air Force Institute of Technology's VAX computer system. The specific tests to be used are one-way analysis of variance (ANOVA) and multiple linear regression using the stepwise method. These techniques are discussed in detail in Chapter III.

Limitations to the Study

The primary focus of this research is directed at established international channels of distribution. The

data for analysis will come from the freight forwarders dealing with the United States Air Force Security Assistance Program. As such, there are certain limitations which must be taken into account before application of the results of this research can be made to the universal case.

First is the nature of the Security Assistance business. The foreign governments, which construct the channels of distribution, do not necessarily plan or design this type of distribution channel with profit maximization as the primary goal. In general, most countries place a great deal of emphasis and priority on national defense. Most often, those who design or manage defense distribution systems tend to build in redundancy in quantity or function in order to ensure that a needed part is available in the right place and at the right time. This redundancy is viewed by them as necessary since having a multi-million dollar weapons system not operational due to a lack of parts is more severe than a simple stock outage to, say, a seller of imported shoes. This redundancy is normally not desirable in a wholly commercial distribution channel. It should be noted that profit maximization is also not necessarily the primary goal of all commercial businesses. However, making generalizations from this study to other international distribution channels must be done with care.

Secondly, while it is desirable for any channel of distribution to have a degree of flexibility built in to

handle emergency operations, the system investigated in this study necessarily has more than normal emergency flexibility in its design. For the reasons stated above plus the fact that arms sales may have significant political overtones, system flexibility may result in a distribution of goods outside the normal (predefined) channel of distribution established for such transactions. For example, in an extreme emergency, such as a declared war, transportation of goods may be made on a government to government basis using internal governmental resources thereby completely circumventing the channel of distribution normally used. Although this should be a rare situation, the reader should understand that such circumstances exist and functional relationships may be influenced by planning for such contingency operations.

A third area which may limit the universal application of this research may be found in channel dynamics as noted by Stern and El-Ansary²⁶ and others. Normally, a supplier or producer the size of the United States Air Force should exert a great deal of influence in any channel of distribution of which it is a member. By law, the United States Air Force may not contract freight forwarding services for foreign governments. The freight forwarder is contractually bound to the foreign government and the services provided depend on that government's desires.

While power relationships exist, they may be exerted by different players within the distribution channel.

The last limitation to this research has to do with the accuracy of the data collected by the International Logistics Center. It is assumed for purposes of this study that the database on the amount of material lost, as documented by the Reports of Discrepancy, is accurate and that no country reports a loss when, in fact, they did not actually have a loss. There is no evidence to support false reporting by the customer countries.

The limitations noted above are not considered sufficiently unique such that the findings of this research must be strictly limited to the Air Force Security Assistance program. Indeed, many of the findings should be applicable to any international distribution channel which is composed of heterogeneous members. Those international distribution channels which are composed of external activities or organizations performing critical logistics functions should gain insight from the findings of this research. These contributions are contained in the following section.

Contribution of This Research

Successful completion of this research should make significant contribution to the field of international distribution. It will provide specific inferences about how

freight forwarders influence the effectiveness and operations of international channels of distribution.

To the field of literature, this study will add significantly to the small body of existing literature in the area of international channel distribution and international channel dynamics. In particular, the analysis of information flows within a channel should provide valuable insights on the importance of channel communications on effectiveness within a defined channel. The study of the facilitating functions performed by freight forwarders will provide empirical evidence on specific logistics operations within the channels of distribution. The function and importance of structural linkages within a channel will be better understood by the analysis of channel operating procedures within certain predefined channels. In general, the freight forwarder's role and function within an international channel of distribution will be more fully understood as a result of this research.

To the practitioner, this research should be valuable in several ways. To the exporter, this study should present a framework for identifying those factors or functions performed by freight forwarders which may cause losses to occur within their own channels of distribution. The exporter may use the findings of this research to select or modify those services performed by their freight forwarder. Depending on the type of channel relationship present in a

channel, the exporter or the customer may use the findings of this research as a framework to evaluate the performance of existing channel members. If such a channel does not already exist, the results of this research may be helpful in establishing new channels of distribution by identifying those services which show the potential to be the most significant factors in an effective distribution channel.

Freight forwarders should also receive benefits from this study. The findings may be used to make an internal audit of the functions they provide or services they offer. Forwarders may then decide to add, eliminate, alter, modify or improve those services or functions. A freight forwarder may use these findings as motivation to improve their competitive position or explore new opportunities if they specialize or excel in those areas identified as most critical to effective operations.

Organization of This Study

This research will be presented in five chapters. Chapter I identified the problem areas and stated the general area of the research. The purpose of this research and its application were discussed. The theses, hypotheses, and sources to be used for data collection were identified followed by a brief review of the methodology to be used in analysis of the data. The limitations to this research as well as the significance of the need for this research were also identified.

Chapter II will contain a review of the relevant existing literature from both the civilian and military fields.

Chapter III will fully outline and explain the methodology to be used for hypotheses testing.

An analysis of the collected data will be presented in Chapter IV.

The final chapter, Chapter V, will contain an evaluation and discussion of the research findings, the conclusions, and the contributions this study has made to the field of international distribution. The chapter will end with identification of possible future research areas.

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CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of Chapter II is to provide the reader with an understanding of the operations involved with, and problems of, international distribution channels focusing on the role of the freight forwarders. It is assumed at this level of review that the firm has already made the decision to export and to utilize the services of freight forwarders in the distribution channel. The primary emphasis here will be to identify the relevant literature in the areas of selecting channel members, forwarder operations and evaluation of existing channel members.

Channels Defined

The classical model of international trade structure is made from three distinct zones: the business system of the export country, the international intermediaries, and the business system of the import country.¹ The international channel of distribution provides the linkages among these three zones.

To understand channel behavior and performance, it is first necessary to understand the nature of distribution

channels. There are, perhaps, as many definitions of distribution channels as there are authors who write about them. The most basic definition of a marketing or distribution channel may have come from Wroe Alderson who described them as a group of firms which "constitute a loose coalition engaged in exploiting joint opportunity in the market."² Through time, this basic definition has been refined many times. From the original French meaning of the word "channel", Revzan suggests that a distribution channel is "the vehicle for viewing marketing organization in its external aspects and for bridging the physical and non-physical gaps which exist in moving goods from producers to consumers through the exchange process...."³ More recently, Walters defined a channel to be "a team of merchant and agent business institutions that combine physical movement and title movement of products in order to create useful assortments for specified markets."⁴ Bowersox cites the American Marketing Association definition of the distribution channel as "the structure of intracompany organization units and extracompany agents and dealers, wholesale and retail, through which a commodity, product, or service is marketed."⁵

The latter two authors stress that distribution channels are composed of multiple members who work in consonance as a team effort. From a systems theory approach, distribution channel members represent a team

within the system while the environment of that system can be either the domestic or international market which impacts upon the channel.⁶ From Berg comes the idea that all enterprises can be viewed as input-output systems made up of 1) the internal organization of the firm, (2) the company environment, and (3) various kinds of external organizations serving to link the process of inputs and outputs.⁷ The distribution channel, the individual team members within that channel, work within a system as just described. The problems of unifying this team effort will be discussed later in this chapter. The importance of the team effort, as well as the problems of the same, are magnified when international channels of distribution are present. The unique aspects of international channels involve the multiplicity of operational and market variables which affect channel decisions rather than individual differences in channel structure.⁸ The functions performed by each channel will differ in scope and form rather than structure.

Types of Distribution Channels: A simplistic, yet encompassing, categorization of distribution channel types is offered by Bowersox, Cooper, Lambert and Taylor. They classify channels into (1) vertical marketing systems, (2) free-flow channels, and (3) single transaction channels.⁹ This scheme is based on acknowledged dependency of the channel members. Vertical systems are characterized by

acceptance of predetermined roles, interdependence among channel members, and a shared belief that all are better off as a team than as individuals. One member of this system accepts a leadership role and exerts influence over other channel members. Vertical systems are relatively stable due to the influence and other's acceptance of the leader's role. Beyond this acknowledged recognition, vertical marketing systems glean power from formal devices. These are described as:

(1) corporate: owned and operated by a single business unit, (2) contractual: independent members bound by contract but not ownership, and (3) administered: formal recognition exists but stability is based solely upon mutual reward.¹⁰

Free-flow marketing channels are characterized by less formal recognition and dependence among members than in the vertical system. Members here do acknowledge the value of specialization and total channel performance. Many free-flow members deal regularly with vertical channels but since they do not acknowledge the power relationships that exist within vertical channels, they do not become full participants.¹¹

The third type of channel is the single transaction channel. These channels usually have no plan or expectation to extend any type of relationship beyond a single transaction.¹² An example of this type of channel would be a real estate transaction where, upon completion of all

details, no further relationship is needed or desired by any of the parties involved.

Whatever classification scheme is used to define a distribution channel or its members, all channels share the common purpose of providing the right product at the right location at the right time. While the mechanics of each channel may be unique, the structure and function of all distribution channels are quite similar.

Channel Structure: The structure of any system is defined by the relationships of the members of that system. In a logistics or distribution system, the structure is determined by the relationship of the flows within that system. This distribution flow concept has evolved through numerous authors¹³ and is generally accepted as having two separate but interrelated types of flows, logistics and transaction-creating, which must be present to have a satisfactory marketing process.

Transaction-creating flows involve those functions which deal with negotiating, contracting, and administering trade on a continuing basis. These flows are related to logistics through their impact on costs and economies of the physical flow.¹⁴

By contrast, Bowersox defines logistical flows to include (1) Adjustment: concentration, selection, dispersement; (2) Transfer; (3) Storage; (4) Handling; and (5) Communication.¹⁵ Just as transaction-creating flows

affect logistics flows, logistics flows impact transaction-creating flows in obvious ways. If material does not arrive at the right place at the right time due to problems in logistics flows, future negotiations, contracts, and indeed, any prospective business may be affected. The two flows work within a common system and are highly dependent upon one another. They are, however, performed independently and are separate flows.

The primary purpose of this separation of transaction and logistics flows is to increase the structural opportunities for specialization. As organizations become more complex they tend to become more specialized.¹⁶ Thus, as channels of distribution become more complex their structures tend to require more specialization. This specialization is performed by one or several intermediaries within the channel.

The idea of specialization being created by complexity of flow relationships is reinforced by Aspinwall's "depot theory of distribution."¹⁷ His theory suggests that the rate of flow in a distribution system is controlled by the customer. If a perfect system existed, no inventories would be required to be held since production would match consumption. There would be no costs incurred for storage, handling or holding goods for speculation. In reality, since a perfect system does not exist, "depots", or intermediate storage and handling facilities for material

are required. Intermediaries in the channel provide these storage, handling and other functions and are paid for their services. Channel membership is thus established.

Given that intermediaries are a necessary and integral part of a distribution channel, it then becomes paramount that careful thought and proper planning be used in selecting a distribution channel strategy.

Distribution Channel Strategy

Although the firm's distribution channel strategy is but one part of overall strategic planning, it is one of the most important. The distribution channel relationships and flows mentioned earlier impact all areas within a firm. Effective planning of the channel must therefore be a primary consideration. As a minimum, management must consider the following areas in selecting a channel strategy. First, the firm's relative power position with respect to the proposed system and any alternatives must be considered. Secondly, management must consider the arrangement of channel commitments and the design process by which alternatives are evaluated. The two flows which were mentioned earlier must be considered together even though they may be working independently. A third criterion for channel strategy formulation is measurement of channel performance. Prior consideration must be given to how the channel as well as its individual members will be measured

for performance or effectiveness. Lastly, management must consider channel flexibility potential and the related dynamics produced during change.¹⁸

It would seem that management should make the necessary and adequate preparations when deciding channel strategy. This is not the usual case. A study by Lambert has shown that most channels evolve as the result to solve a problem. Further, the study points out, channels seldom change substantially from their basic structure.¹⁹

The design of the distribution channel should be the natural outgrowth of a firm's channel strategy. Bucklin defines a normative channel as "that group of channel institutions that generates maximum profits and consumer satisfaction per dollar of product cost."²⁰ To produce such a normative channel, nine steps have been proposed. These are:

1. Formulate channel objectives.
2. Develop channel strategy.
3. Determine channel structure alternatives.
4. Evaluate channel structure alternatives.
5. Select Channel structure.
6. Generate alternatives with regard to specific channel members.
7. Evaluate and select individual channel members.
8. Measure and evaluate channel performance.
9. Modify channel arrangements if and when necessary.²¹

The authors point out that channels may not obtain the normative structure due to the influence of social, cultural, political, competitive and economic variables.

Berg offers a different distribution model for producers. The five interrelated stages are: (1) factoring the company-wide strategic situation, (2) converting key factors into functional prerequisites for the system, (3) grouping individual tasks into work units, (4) allocating tasks to appropriate functionaries, and (5) designing a structure of relationships to provide loci of distributive authority and responsibility within the work structure erected in previous stages.²² The value of this design lies in its ability to identify all the parts within the system and to then define the relationships which exist, or must be made to exist, between all participating members.

Mallen produces a different list of five factors which should be analyzed by managers designing distribution channels. His points include:

1. The selected target markets.
2. The rest of his marketing mix: price, product, promotion, physical distribution, etc.
3. The company's resources.
4. Competition and other external forces.
5. Current and anticipated distribution structure in his industry.²³

Although presented in different terms and words, all these models are saying the same basic things. Most authors agree that when making decisions pertaining to channel structure and strategy, a systems approach should be taken. A model by Walters is shown in Figure 1. Although Walters does not call his method for channel strategy and structure a systems approach, it appears to be one none the less. A more recent study for channel design can be seen in Lambert's work. He stresses the importance of the systems approach by using a cost trade-off analysis between the basic distribution cost categories. The main purpose of this model is to minimize total system cost.²⁴ Lambert's model is shown in Figure 2. The economic analysis of distribution becomes significantly more complex when taken in a global context.

While the various authors differ in terminology, the differences are mostly in degree rather than substance. The degrees of difference are most evident when the channels of distribution become international. An example to illustrate this point can be shown from Davies. He suggests that in addition to the cost variables noted above, non-transportation cost variables are perhaps most critical in international distribution. These variables include:

1. Speed of service, reliability, time-in-transit, dependability, and transit variability

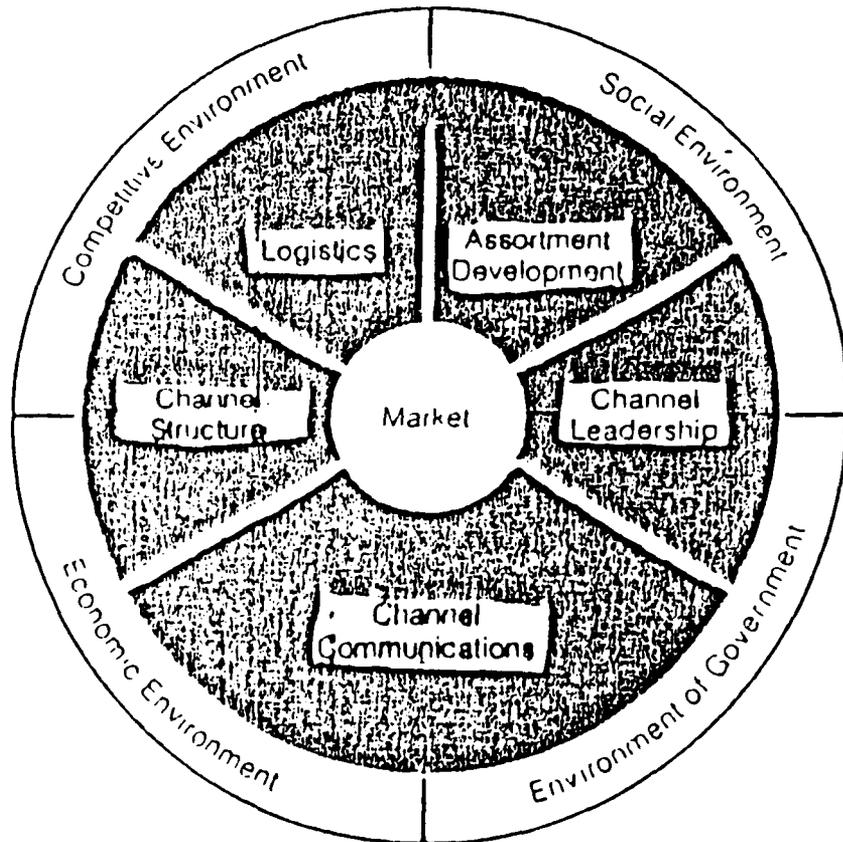
2. Loss and damage
3. Inventory levels
4. Product characteristics.²⁵

The systems approach is still the most germane but additional variables enter the decision processes as shown in the expanded systems model chart shown in Figure 3.

Because of the potential for significantly larger sums of money to be involved in the distribution channel structures, most authors start the discussion of international channel strategies and structures by emphasizing the importance of long term strategic goals of the firm.

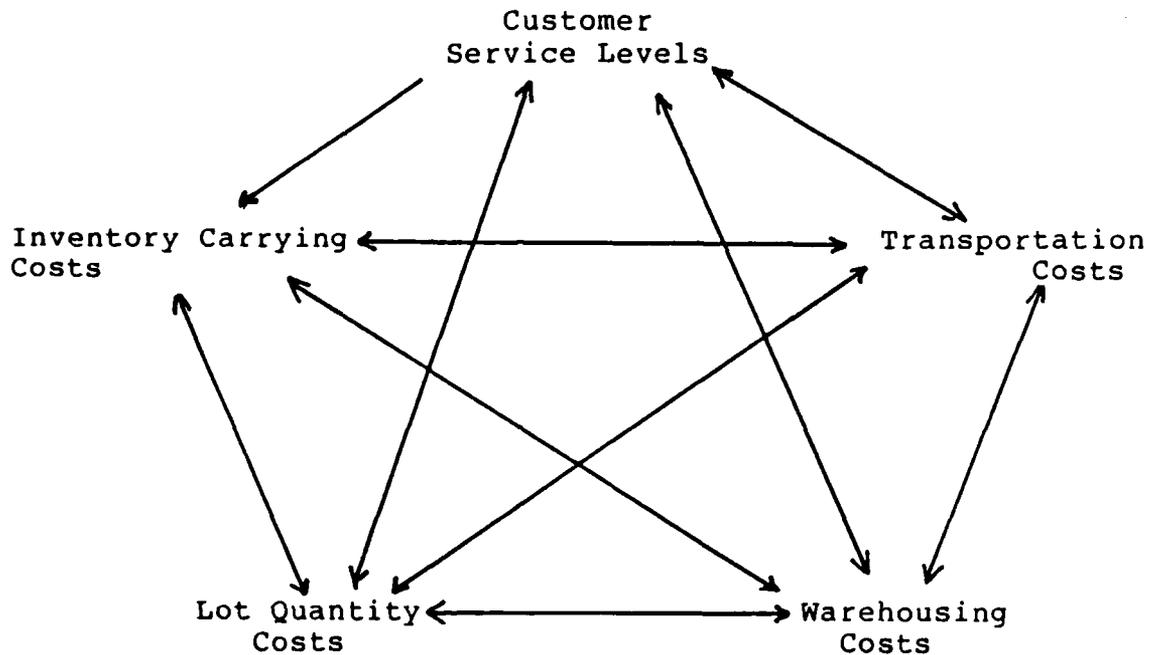
Cateora begins a discussion of the factors affecting choice of channels by stating: "While the overall marketing strategy of the firm must embody the company's goals of healthy profits in the short and long run, the channel strategy itself may be considered to have six very specific strategic goals."²⁶ These are listed as (1) cost, (2) capital requirement, (3) control, (4) coverage, (5) character, and (6) continuity.²⁷

Robinson stresses the importance of considering management's time horizon and the target market's relative overall importance to the firm when considering channel design. When deciding who should bear the risk and



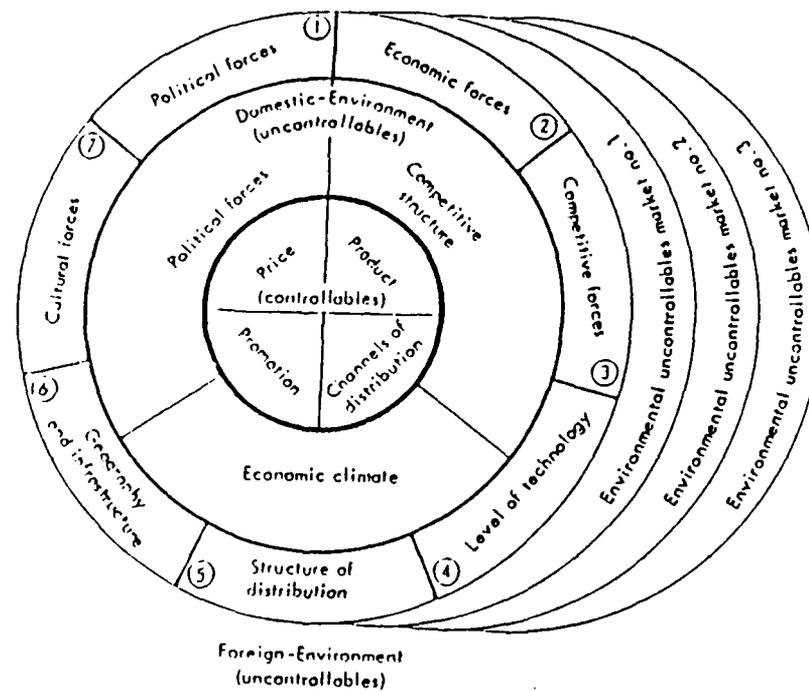
Source: C. Glen Walters, Marketing Channels, Goodyear Publishing, Santa Monica California, 1977, p. 18.

FIGURE 1
VARIABLES OF THE CHANNEL SYSTEM



Source: Douglas M. Lambert, The Development of an Inventory Costing Methodology; A Study of the Costs Associated with Holding Inventory (Chicago: National Council of Physical Distribution Management, 1976), p.7.

FIGURE 2
COST TRADEOFFS REQUIRED IN THE LOGISTICS SYSTEM



Source: Philip R. Cateora, International Marketing,
 (Homewood, Ill., Richard D. Irwin, Inc., 1983) p. 7.

FIGURE 3
 THE INTERNATIONAL MARKETING MIX

responsibility, he suggests management consider the following areas when making channel decisions:

1. Market size and profit potential.
2. Availability of specialized export skills.
3. Desirability of direct relation with the foreign market.
4. Likelihood of eventual foreign production.
5. Possibility of supplying market from third source.
6. Costs associated with developing exporting expertise.²⁸

Keegan expands these criteria by adding individual country characteristics as an important factor in channel choice. He states that "what is appropriate in one country may not be effective in another."²⁹ While this may hold true for individual domestic markets as well, it points out the differences in magnitude when dealing internationally where differences in culture, language, and customs vary greatly. He states that the characteristics of customers, products, middlemen, and the environment should be considered as constraints on the distribution system.

Government influence and regulations also present a constraint upon international distribution systems. Fayerweather points out that uncontrollable changes in foreign government policies or administrations can immediately negate the operations of otherwise well

conceived distribution channels.³⁰ This single criteria is perhaps responsible for the need to evaluate risk transfer or sharing in international distribution channels. He summarizes logistics strategy goals as:

"(1) efficiency in the transmission of resources maximizing their flow in the natural direction determined by economic differentials and government actions; (2) utilization of the potentials of unification in production facilities and other respects to make the maximum use of the special advantages of the Multinational Corporation as a global organization; (3) effectiveness in implementing resource transmission, especially with respect to skills for which communications are a critical factor."³¹

To illustrate the need for such strategic considerations, Fayerweather uses the Singer Corporation as an example. When the Japanese entered the export market with low-cost labor and mass production, Singer's logistics system was not in a position to remain competitive. Singer's global production was based primarily in U.S. and European facilities. Since the production of sewing machines is labor intensive, low-cost labor producers such as those typically found in Asia posed a significant threat to the survival of Singer. Eventually, Singer was able to recover but only after a major restructuring of its logistics system which included establishing export capabilities in Japan, Brazil and Taiwan.

As Fayerweather pointed out: "there is an inherent inertia in a logistics system that substantially impedes it

in adjusting to shifts in economic relationships to which it should be geared efficiently."³² He notes that such differentials evolve gradually rather than abruptly and therefore Singer and others should be cognizant of these changes and make constant logistics decisions rather than letting inertia prevail. He suggests a two-phased "predictive planning" process to overcome this inertia. Phase one would have the company identify its key resource transmission capabilities in view of the overall pattern of global evolution of economic and government conditions affecting those capabilities. Secondly, using the strength and power of the large multinational corporation, the company should unify and integrate global production and marketing strategies.³³ He cites General Motors efforts in Southeast Asia as a positive example of this two-stage planning process. GM advanced a concept of rationalized local production of automotive parts integrated with its development of a vehicle designed specifically for that market area.³⁴ Such a strategy, according to Fayerweather, will help to attain the logistics goals as stated earlier in this chapter.

While the various authors may not agree on which factor is of prime importance, they all list multiple criteria which must jointly be considered when dealing in the international environment.

Control in the Channel

As Selera points out, the type of channel design will depend on the overall amount of control the firm wishes to exercise.³⁵ The design of the channel impacts, and is impacted by, control within the channel. Walters suggests that channel structure "affects functions as they relate to: (1) control over the performance of functions, (2) speed of delivery, and (3) cost of operations."³⁶ Control of the channel functions and members themselves depends on many factors which may or may not be influenced by the firm.

Many years ago, Peter Drucker contended that the economic development of a country could be improved by a marketing system which could "integrate the needs, wants, and purchasing power" of the nation.³⁷ He cited Sears, Roebuck and Company as an example of a company which could combine those areas into an effective system. By helping local manufacturers sell their goods, Sears helped match supply and demand while at the same time added to the economic development of that country.³⁸ Research by Oritt and Hagen suggest that there are several theories related to channel structure and economic development. One theory holds that channels must be present in order for economic development to take place. This "precursor" theory suggests that without channels there are no markets and without markets there is no desire, willingness, or ability to purchase. Thus, if no markets are available there will be

no advances made in the economic development of that nation. The counter theory, called the "reflection" theory, suggests that the channel structure within a nation is a reflection of given stage of economic development.³⁹ This latter theory is supported by the studies of Wadinambiaratchi, as noted later in this chapter. The authors submit that other theories relating economic development and channel structure are also plausible and conclude that "whatever the relationship between marketing channels and economic development, there is a clear and immensely important connection between the two."⁴⁰ Other studies are able to be more definitive about the conclusions when dealing with economic development and distribution channels.

A correlation has been found between the economic development of the country and the length of the channel of distribution.⁴¹ Generally, as the length of the channel increases, the amount of control of the channel leader is decreased.⁴² Bartels states that: "In low economic development, merchant wholesalers tend to dominate distribution channels, but, with increasing industrialization, channel command becomes held more by other channel members."⁴³ Control is also affected by many other variables as has been noted by various authors.

The two flow system as previously discussed, is also noted by authors writing on international distribution channels. Cateora identifies control over the system and

control of the middlemen as the two types of controls which are necessary in international business.⁴⁴ System control is necessary to ensure logistics flows are achieved while control over the middlemen's operations are required to check the transaction-creating flows. These two types of flows parallel those referenced by Bowersox, et al., for domestic channels. As in domestic operations, the purpose of separating the two types of flows is to increase the possibilities for specialization. The degree of specialization in the logistics arena, again, depends to a large part to the stage of economic development of the country in which the distribution channel operates.

Economic differentials, and the complexities they produce, are a main factor in a firm's strategic marketing plan, beginning with the basic decision on what organizational structure should be used to enter international business.⁴⁵ Exporting, joint ventures, wholly owned subsidiaries, and management contracts are but some of the types of organizational structures which firms may use in global operations. These alternative structures, their strong points as well as their shortcomings, are well documented by numerous authors.⁴⁶

From an exporting perspective, the firm must be mainly concerned with the availability and capability of the potential members of the distribution team. Once the distribution channel strategy is established and the

functional requirements and their interrelationships are identified and understood, the firm must then select members to perform the required functions. The individual and collective capabilities of the channel members will dictate the amount of control available to the firm as well as the length of the distribution channel, which has been shown to be dependent upon the stage of economic development of the country or countries involved in the distribution channel. Salera sums up this condition by stating "expansion of markets (internationally) usually means that the distribution function becomes more specialized and that more intermediaries become involved. That is, the distribution channels lengthen....".⁴⁷

As distribution channels lengthen, and more intermediaries become involved, individual differences in abilities will affect the effectiveness of the channel. Key elements in the choice of which intermediaries to use are the availability and capability of channel intermediaries.⁴⁸ To reinforce this thought, Wadinambiaratchi reports on a study involving marketing studies in nine areas which compared twenty-two fields of economic development for affects on distribution channels. The study concluded that:

1. The more developed countries have more levels of distribution.
2. The influence of the foreign import agent declined with economic development.

3. Manufacturer-wholesaler-retailer functions become separated with economic development.

4. Wholesaler functions approximate those in North America with increasing economic development.

5. Financing function of wholesalers declines and wholesale mark-ups increase with increasing development.

6. The number of small stores decline and the size of the average store increases with increasing development.

7. The role of the peddler and itinerant trader, and the importance of the open-garden-fair declines with increasing development, and

8. Retail margins improve with increasing economic development.⁴⁹

Differences in economic development, lengths of distribution channels, levels of specialization, and abilities of the intermediaries are all related as enforced by the above mentioned study. Selecting the intermediaries is the final stage in developing a firm's international distribution channel.

Selecting Channel Intermediaries

It is interesting to note that selection criteria for international channel intermediaries and domestic channel intermediaries are closely related. A comparison of selection criteria is shown in Table 3. As before, international channels of distribution add extra dimensions

to the selection criteria. In addition to the criteria shown in Table 3, such other considerations as the intermediary's command and understanding of the firm's native language and operating procedures must be included. Customs and culture are also powerful influences which must be considered. A final consideration which must be made is the difference in legal environments of the countries concerned. In the United States, it is fairly easy to dismiss channel members when they are no longer a desired part of the organization. In other countries of the world, the middlemen may have some legal protection which makes it difficult or impossible to terminate contractual relationships.⁵⁰ If for no other reason, the legal impacts make planning and selection of middlemen extremely important when establishing international channels of distribution.

Selecting the Freight Forwarder

Recent studies indicate that the role of the international freight forwarder is increasing and will continue to increase. A survey conducted by Distribution Magazine for the National Council of Physical Distribution Management in 1983 revealed that greater than 80 per cent of the companies surveyed used an outside freight forwarder service for their international shipments.⁵¹ Further, the decision on which services to use was made by the transportation or distribution department in 83 per cent of the cases.⁵² Perhaps the most interesting implication for

TABLE 3
SELECTION CRITERIA

DOMESTIC	INTERNATIONAL
1. Size of member	1. Product Information
2. Sales Strength	2. Product Lines
3. Product Lines	3. Size of firm
4. Sales Force	4. Reputation
5. Market Coverage	5. Background Information
6. Sales Performance	6. Credit References
7. Management	7. Personal Observation
8. Advertising and Sales Promotion	8. Reputation
9. Sales Compensation	
10. Acceptance of Training Assistance	
11. Transportation Savings	
12. Inventory	
13. Warehousing	
14. Lot Quantity Costs	

Source: Adapted from Douglas M. Lambert, The Distribution Channels Decision (New York, National Association of Accountants, 1976), p. 37; and Philip R. Cateora, International Marketing (Homewood, Ill., Richard C. Irwin, 1983), p. 637-638.

freight forwarder involvement is the statement made by companies who planned greater international activity. The majority indicated a greater use of "third party" intermediaries for exporting and importing.⁵³ This indicates that freight forwarding will continue to be a significant and important external variable to firms in international business in the future.

As noted in Chapter I, since deregulation of much of the transportation industry has occurred, freight forwarders are offering a greater range and depth of services to their international customers.⁵⁴ Typical services offered by freight forwarders to companies who are exporters are shown in Table 4. Additionally, services commonly offered by forwarders to foreign buyers are shown in Table 5. Woods and Johnson list the following as typical services of freight forwarders:

1. Booking space of carriers.
2. Preparing export declaration.
3. Preparing air waybill or bill of lading.
4. Obtaining consular documents.
5. Arranging for insurance.
6. Preparing and sending shipping notices and documents.
7. Advising the shipper as to selection of terms of sale.
8. Serving as general consultant on export matters.⁵⁵

In addition to those services, Cateora includes the offering of warehouse storage space, packing and containerization as normal freight forwarder functions.⁵⁶

TABLE 4
FREIGHT FORWARDER ACTIVITIES

1. Quote Carrier Freight Rates
2. Charter Vessels or Obtain Necessary Space
3. Obtain Export Licenses
4. Obtain Delivery Permits
5. Advise Shipment Status
6. Obtain Warehouse Space
7. Inspect Material for Shipper or Buyer
8. Trace or Expedite Shipments
9. Pay Freight Charges for Shipper
10. Obtain Dock Receipts
11. Issue Export Declarations
12. Prepare Consular Invoices
13. Prepare Commercial Invoices
14. Compile and Verify Bills of Lading
15. Prepare Certificate of Origin
16. Obtain Insurance
17. Assist in Translation
18. Collect and Submit Money for Shipments

Source: Adapted from A. Murr, Export/ Import Traffic Management and Forwarding, Sixth Edition, (Baltimore, Maryland: Cornell Maritime Press, Inc., 1979), p. 294.

TABLE 5
FREIGHT FORWARDER ACTIVITIES
OFFERED TO BUYERS

1. Instructions received from buyers are recorded and checked against those received by shippers.
2. Follows up orders with suppliers.
3. Export licenses are filed on behalf of the exporter
4. Proper ocean freight rates are applied using the exporter's conference contract agreement or the forwarder's freighting contract.
5. Orders are consolidated if possible on one bill of lading.
6. Shipments are routed economically from interior points to the most favorable port of exit.
7. Expediting and tracing of shipments is conducted.
8. Payment of suppliers invoices is made from funds on hand or under letter of credit.
9. Banking and credit information services are provided.
10. He acts as a business directory for the importer thus securing sources of supply.
11. He insures that coverage of insurance applies under the own policy.

Source: Adapted from Uche S. Okefor, The Role of the International Freight forwarder in the U.S. Export Market, (Dissertation, The Ohio State University, 1982), p. 54-55

The complexity of international shipments is often cited as the main reason companies shy away from dealing internationally. Gray and Davies note that an average international shipment often involves 40 separate documents, with constant transfer of repetitive data from one document to another, with as many as 25 parties participating.⁵⁷ Davies notes that the important thing for an exporting company to do is to stick to a forwarder the company can be comfortable with and who can meet his basic needs.⁵⁸ While this may be the easiest method of dealing with freight forwarders, it surely is not the most effective. As in any distribution system, analysis of function and performance should be a matter of routine and constant update. This should be especially true in international distribution systems where changes are constant and dynamic. Unfortunately, there is little written on the means to measure international distribution performance even though the need to evaluate such systems seems clear.

Evaluation of the Distribution Channel

Literature in the field of channel performance measurement or evaluation is very sparse. Lambert cites

three possible explanations for this phenomenon:

1. Measuring channel performance is difficult.
2. Some aspects of channel performance may be difficult to quantify, making a unified index of performance difficult to achieve.
3. Published standards are not available for industry comparisons.⁵⁹

His study, conducted on domestic companies, does ask for specific ways companies measure channel effectiveness. Table 9 shows some of the criteria commonly used to measure efficiency as offered by El-Ansary and Cooper.⁶⁰ Lambert's study revealed that there are a multiplicity of measures used to evaluate certain aspects of the distribution channel. Common carriers were evaluated in two-thirds of the cases by damage or claims reports. Public warehousemen were evaluated on the basis of warehouse inspection reports, costs, inventory reports, customer complaints, and safety and environmental factors. Costs of functions performed seemed to be the single most used measure for most operations. The most alarming finding of this study was that the majority of manufacturers had no specific data or reports to measure the performance of the total channel.⁶¹

A search of international literature for any similar studies of performance evaluation ended in frustration. Most international text books mention the importance of the distribution decisions in overall strategy planning but are

TABLE 6
MEASURES OF CHANNEL STRUCTURE EFFICIENCY

1. Number of channel levels
2. Number of outlets per level
3. The extent and distribution cost outcome of functional shifting in the channel.
4. The extent and distribution cost outcome of functional substitution in the channel.
5. The extent and distribution cost outcome of functional interchange in the channel.
6. The extent and distribution cost outcome of postponement in the channel.
7. The extent and distribution cost outcome of speculation in the channel.
8. Availability of clear channel policies on:
 - a. inventory levels
 - b. transportation
 - c. warehousing
 - d. customer service
 - e. pricing and discounts
 - f. promotion
9. Extent of channel member turnover.
10. Market image of channel members.
11. Financial strength of channel members.
12. Competitive strength of channel.

Source: Douglas M. Lambert, The Distribution Channels Decision (New York, National Association of Accountants, 1976), p. 39, taken from Abel I. El-Ansary and M. Bixby Cooper, "An Exploratory Framework for Examining Distribution Channel Performance", unpublished paper, Louisiana State University, 1976, pp. 8-9.

vague in just how such a channel should be measured or evaluated.

An article in writing at this time by Professor Warren Bilkey, Professor of International Business at the University of Wisconsin-Madison, hits the heart of this problem. His study asks Wisconsin exporting companies to rank order their current export practices with those practices they perceive to be most optimal from a profit point of view. The results show little correlation between export practices used by these companies and those perceived to be most profitable. He concludes that companies used their existing practices because "management currently has no clear means for identifying which export practices are optimal with respect to profit."⁶² It seems there is a need for studies and empirical data showing just how multinational companies as well as domestic companies dealing internationally through exporting evaluate their existing channels of distribution.

Summary

This preliminary review of the literature on distribution channels has shown that there is a significant amount of information on channel strategies, channel design and selection of distribution channel intermediaries. Certainly, this review has not covered all the pertinent literature available on distribution channels, but has

pointed out that there are certain similarities between domestic and international channel management. It also shows that most of the literature deals with the macro design and management of channels. There is little written on qualitative measures for evaluation and management of distribution channels at the individual firm level.

It seems apparent that there is a real need for studies to be conducted on how individual firms manage selected channels of distribution, not only in the domestic environment but especially in the global arena. As international business becomes an even greater part of American business activities, basic understanding of international channel management gains greater importance.

This study attempts to measure the impact of selected freight forwarder services on the effectiveness of a predefined international distribution channel. Effectiveness, measured in this study, will be an index of dollar losses as a percentage of total shipment value within the specified channel. Selected freight forwarder functions will be analyzed to determine their importance and impact on losses within their international distribution channels. The processes involved, the rationale for these measures, and the methods used in evaluation of these processes are the subject of the next chapter.

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CHAPTER III

METHODOLOGY

Introduction

The purpose of this chapter is to define and develop each of the research variables, develop the hypotheses, explain the design and proposed administration of the questionnaire, and to identify and explain the statistical methods used in testing the various hypotheses. The testing and results of the hypothesis will be based on the questionnaire replies and will be discussed in Chapter IV.

The primary thrust of this research centers on the thesis that losses of material in the distribution channel are a function of the various services performed by the freight forwarders in that channel. This research uses a distribution channel in which freight forwarders all receive material from the same source but export to one or more of several customers.

Figure 4 shows the typical distribution channel for the United States Security Assistance Program. This distribution channel is composed of a single producer, 126 freight forwarders, and 55 customers. The single producer may in actuality obtain material for export from commercial

Producer (1)___Freight Forwarders (126)_____Customers(55)
(United States (Foreign Countries)
Air Force)

FIGURE 4
SECURITY ASSISTANCE DISTRIBUTION CHANNEL
MATERIAL FLOW

or other Department of Defense manufacturing sources. The freight forwarders used in this research are all contractually bound to the customer rather than the producer. The customers are the countries with which the United States sells military supplies and equipment through the Security Assistance Program.

At the start of this research, all freight forwarders were considered to have the same potential for offering services and were therefore considered to be a homogeneous group for testing purposes. Individual differences will define groups for subsequent testing according to their responses to the questionnaires and other information based upon interviews of country representatives. These groups are defined for each variable in the following paragraphs.

Dependent Variable: The dependent variable used for each hypothesis test will be the "loss index" which is defined as the ratio of the amount of material lost divided by the amount of material shipped through the forwarder. This index was identified in Chapter I. The Reports of Discrepancy (RODs) are United States Air Force forms used in the Security Assistance Program which identify shipments that are either not received or received in other than ordered condition.

A special Air Force program will be run to gather this data. Information from that program will identify the shipment by requisition number, the freight forwarder the

shipment was routed through, the country of destination, and the dollar value of the requisition. This will allow all losses to be identified to a specific freight forwarder since the entire process (requisition through feedback from proposed recipient) will be closed.

Independent Variables: The variables used for each hypothesis to be tested form the group differences for Analysis of Variance (ANOVA) tests.

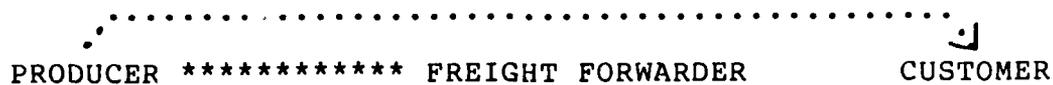
Variable 1: Type of data transmission. (H1.1, H1.2, H1.3) In these distribution channels there are three types of data transmission in use. Those are: 1) TELEX, 2) Dataphone, and 3) International mail services. Each has its own characteristics, advantages and disadvantages. Freight forwarders will be divided into one of the three groups based upon the data transmission type most frequently used. If a forwarder uses a combination of two or more types, it will be so noted and a fourth group will be used in the ANOVA testing.

Variable 2: Channel of information flow. (H2.1, H2.2, H2.3) This variable tests how information is communicated through the channel of distribution. In all cases, shipping information is sent to the customer from the producer by the means identified above. However, information can go to other channel members. This latter type of data flow is the object of this variable. Again, there are three types of flows used in these distribution channels which will form

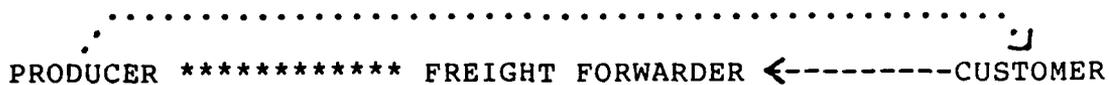
the groups for testing. Type 1 has information flowing from the producer directly to the customer as in the usual case. The customer then informs the freight forwarder by whatever means are normally used, as identified in Variable 1. Type 2 information flows directly to the freight forwarder from the producer. The forwarder then notifies the customer of subsequent shipment. Type 3 is similar to Type 2 except that the forwarder does not provide subsequent shipment status to the customer. These information flows are shown in Figure 5. The three groups will be compared for significant differences using ANOVA procedures.

Variable 3: Amount of inspection. (3.1) Groupings for analysis of this variable are divided by the amount of inspection done to the material by the freight forwarder when it is received at the forwarder's facility. Using a panel of experts¹ with those most familiar with forwarder operations in this distribution channel, it was determined that inspecting (5) per cent of the received material was a natural breaking point for division into two groups for testing differences in means. Therefore, forwarders inspecting up to (5) per cent of material received will compose one group and those forwarders inspecting five (5) per cent or more will make up the second group. These two groups will then be tested for significant differences using ANOVA testing procedures.

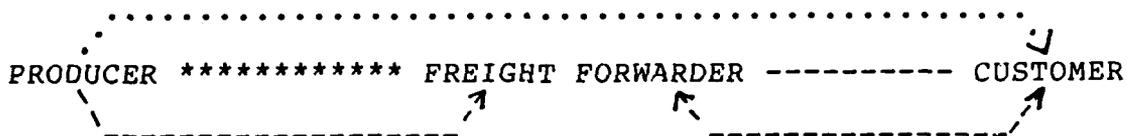
STANDARD (ALL COUNTRIES)



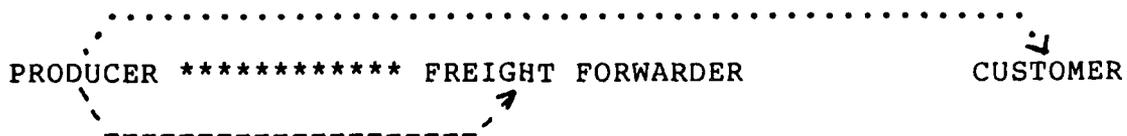
TYPE 1



TYPE 2



TYPE 3



- Normal information flow
- Additional information flow
- ***** Shipping Document with Material

FIGURE 5
INFORMATION DATA FLOWS

Variable 4: Consolidation policies. (H4.1, H4.2, 4.3) The first hypothesis (H4.1) will test whether forwarders who hold material for full consolidation differ significantly from forwarders who do not consolidate shipments. From the group of forwarders who do consolidate material for shipment two new groups will be determined depending on what type of information is supplied to the customer. One group will consist of those forwarders who provide a new consolidated bill of lading which has identified all smaller shipments within the consolidated shipment. The other group will be those forwarders who do not provide such a list to the customer. These two groups will be used to test Hypothesis 4.2. To test the last of the consolidation hypotheses (H4.3), two groups of forwarders will be formed using consolidation of material from more than one producer as the determinant for group membership. Some forwarders may receive material for shipment from more than one producer. This may be the cause of some loss problems and that by itself will be tested in Hypothesis 10.2. In this hypothesis (H4.3), only the consolidation with other producer's material will be of concern. Those forwarders who do combine several producer's material into a single shipment will comprise one group while those who consolidate only one producer's material will make up the second group. Again, both groups will be tested for significant differences using ANOVA testing procedures.

Variable 5: Shipment to multiple Ports of Entry. (H5.1)

Two groups of forwarders will be determined based upon whether they ship material to one or multiple Port(s) of Entry in their customer's country. Analysis of Variance procedures will be used to test if there are significant differences between the two groups.

Variable 6: Type of Carrier. (H6.1, H6.2) Freight

forwarders will be asked to specify whether shipments are sent via water or air carriers. If a forwarder uses one mode exclusively, it will be placed in that modal group. If the forwarder uses a combination of air and water transportation modes, individual Reports of Discrepancy will be placed within the appropriate group. This will test the type of mode used by the freight forwarder's, which is the object of Hypothesis 6.1. The same process will be used to test if there are differences between carriers of United States registry and foreign (non-United States) registry. If a forwarder uses both types of carriers, the individual Reports of Discrepancy will be used to place losses within the appropriate group. Analysis of Variance procedures will be used for testing.

Variable 7: Volume of Traffic (H7.1, H7.2) Both these

hypotheses are designed to test if the volume of traffic alone causes losses to occur. Two types of testing will be done on traffic volume. First a simple regression analysis will be performed using the dollar value of material lost as

the dependent variable and the total dollar value of the customer's program as the independent variable. A second regression will be run using total shipments lost as the dependent variable and the total shipments as the independent variable. These two tests, for Hypotheses 7.1 and 7.2, will indicate if a relationship exists between losses and total volume of traffic in the channel. A second set of tests using ANOVA methods will divide freight forwarders into three groups based upon the percentage Security Assistance Programs represent of their total business. Each forwarder will be asked to identify what percentage of their total business is composed of strictly United States Air Force Security Assistance Program material. Groupings for these tests was arbitrarily set at less than 20 per cent, 21 to 50 per cent, and greater than 50 per cent of their total business. The ANOVA tests will indicate if there are significant differences between or among these three groups.

Variable 8: Facilities Provided (H8.1) It has been noted that the services required of a distribution system vary in accordance with the needs of the members, export marketing strategy, and product characteristics.² The services normally provided by the freight forwarders in an international distribution channel can be found in a number of sources.³ Table 7 lists a sample of those services which are normally associated with international freight

TABLE 7

TYPICAL FREIGHT FORWARDER SERVICES

- | | |
|--|-------------------------------------|
| 1. Obtain Export Licenses | 11. Obtain Insurance |
| 2. Provide Warehouse and Storage Space | 12. Give Notice of Shipment |
| 3. Receipt and Storage of Material | 13. Discrepancy Reporting |
| 4. Process Material for Transshipment | 14. Multiple Delivery Capability |
| 5. Make Transportation Arrangements | 15. Provide Tracer Action |
| 6. Customs Clearance | 16. Pilot Pickup of Material |
| 7. Financial Management | 17. Administrative Responsibilities |
| 8. Claims Filing | 18. Reporting System |
| 9. Return of Material | 19. Control of Shipments |
| 10. Prepare Documentation | 20. Inspection of Material |

Source: Adapted from Uche S. Okeafor, "The Role of the International Freight Forwarder in the U.S. Export Market," Unpublished Dissertation, The Ohio State University, 1982, p. 78, and Air Force Manual 75-2, p. 1-2.

forwarders. Those which are of interest to this research are included in the questionnaire. Upon receipt of the completed questionnaire, a breaking point to determine which forwarders offer "full service" to their customers and those who do not will be made. These two groups will then be compared by ANOVA procedures to determine if significant differences appear.

Variable 9: Customer Representative (H9.1) This hypothesis will be used to determine if there are any significant differences between forwarders who have a country representative in the United States and those who do not have such representation. These representatives are non-United States civilian or military members of the customer nation who perform shipment tracking duties for their country. Neither the level of effort nor the level of expertise of these individuals are considered in this analysis. The two groups formed by this decision variable will be tested using Analysis of Variance testing procedures.

Variable 10: Exclusivity (H10.1, H10.2) Hypothesis 10.1 will use ANOVA procedures to test for differences between two groups of freight forwarders. One group will include those forwarders who provide services for only one customer within a single country. An example here is a forwarder who deals only with United States Air Force material sent to foreign air force customer. The second group will be made

up of those forwarders who perform on behalf of more than one customer within a country. This group handles material for a non-United States air force plus a commercial concern or another service within their country. The second hypothesis (10.2) addresses the issue of forwarders who receive material from multiple sources. One group consists of forwarders who receive material from only a single source, here the United States Air Force (includes material from civilian contractors delivering material through the Air Force system to the forwarder). The second group contains those forwarders who receive material from multiple sources; as used here this includes the United States Air Force plus other producers (includes other Department of Defense activities, Army, Navy, as well as material destined for commercial businesses within their customer country). Analysis of Variance procedures will also be used to test for significant differences between the two groups.

Variable 11: Material flow times. (H11.1) Hypothesis 11 tests to see if material losses are due to the amount of time the material takes to clear the freight forwarder facility. The length of time it takes from time of receipt at the freight forwarder to the time it leaves his facility will determine the flow time studied here. A panel of experts⁴ was used to determine that a break should be made between groups at the five day time period. Those forwarders who turn material in five days or less are in one

group. Those who keep material at their facilities longer than five days comprise the second group. Analysis of Variance will be used to determine if there are significant differences between these two groups.

Variable 12: Economic development. (H12.1) The relative economic development of a country has been identified as a possible factor in the distribution effectiveness of a country.⁵ As this is a possibility, it is felt that losses of material could also be related to such economic development. The purpose of Variable 12 is to determine if economic development does account for significant differences between groups in this distribution channel. The Organization of Economic Cooperation and Development has defined countries of the world into two categories, developed and developing. These two categories will be used to establish two forwarder groups for testing with ANOVA procedures. If a single forwarder serves countries from both groups the groups will be redefined to include dollar value of losses. In that case, a simple regression analysis will be performed using dollar losses as the dependent variable and two economic development groups as the independent variables.

Data Collection

For the reasons previously stated, dollar value of material loss in a specified channel of distribution for each country studied will be used as the dependent variable for this research.

Affecting that dependent variable are twelve independent variables which have been identified in Hypotheses 1 through 12 of the Research Hypothesis section of this chapter. The sources of data for each independent variable are shown below. A brief definition of each data source is as follows:

1. Customer/country managers- United States Department of Defense civil service members or Air Force officers who manage the customer/country programs. Located at Wright-Patterson Air Force Base, Dayton, Ohio.

2. Country Representatives-Foreign Liaison Officers who are expatriate country representatives at Wright-Patterson Air Force Base, Ohio. Their duties include shipment tracking but not shipment planning.

3. Freight Forwarders-United States civilian commercial organizations who are contractually bound to a foreign government but not the United States Air Force. They are located throughout the United States.

For each country selected, primary and secondary data sources will be compared for accuracy of response reporting.

The proposed sources for each variable are presented as follows:

Variable 1: The type of data transmission affects material loss.

Primary: Country managers (interview)

Secondary: Freight forwarders (questionnaire)

: Country representatives (interview)

Variable 2: The type of data information flow affects material loss.

Primary: Freight forwarders (questionnaire)

Secondary: Country manager (interview)

Variable 3: The amount of inspection done by the freight forwarder affects material loss.

Primary: Country managers (interview)

Secondary: Freight forwarder (questionnaire)

: Country representatives (interview)

Variable 4: The consolidation policy of the freight forwarder affects material loss.

Primary: Freight Forwarder (questionnaire)

Secondary: Country managers (interview)

Variable 5: Shipments to more than one Port of Entry (POE) affects material loss.

Primary: Freight forwarder (questionnaire)

Secondary: Country representatives (interview)

: Country managers (interview)

Variable 6: The type of carrier affects the amount of material loss.

Primary: Freight forwarder (questionnaire)

Secondary: Country manager (interview)

: Country representative (interview)

Variable 7: The volume of traffic of a customer's program affects material loss.

Primary: Security Assistance Program Accounting and Reporting System (HO-51)

Secondary: Country manager (interview)

: Country representative (interview)

Variable 8: The presence of a country representative affects material loss.

Primary: Country manager (interview)

Secondary: Country representative (interview)

: Freight forwarder (questionnaire)

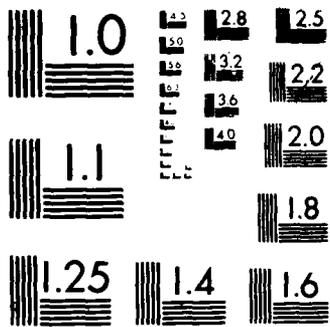
Variable 9: The facilities provided by the freight forwarder affect material loss.

Primary: Freight forwarder (questionnaire)

Variable 10: Performing as an exclusive freight forwarder affects material loss.

Primary: Freight forwarder (questionnaire)

Secondary: Country manager (interview)



MICROCOPY RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS 1963 A

Variable 11: The flow time through the freight forwarder affects material loss.

Primary: Country managers (interview)

Secondary: Freight forwarder (questionnaire)

Variable 12: The economic development of a country affects material loss.

Primary: As defined by the Organization for Cooperation and Development.

Design of the Questionnaire

Much of the data for analysis of freight forwarder operations will be obtained from a questionnaire which will be sent to all freight forwarders doing business with the United States Air Force Security Assistance countries. The questionnaire necessarily uses jargon, form numbers, and relationships which are unique to the Security Assistance business. During development, the questionnaire was coordinated with the Air Force Logistics Command transportation personnel as well as people who work for the International Logistics Center. Both of these groups have frequent contact with the freight forwarders and are familiar with their operations. Each question was reviewed for appropriateness and relevancy.

The purpose of the questionnaire is to gather information from the freight forwarders in five areas. The first area will determine what type of documentation and

communication flows exist within their channel of distribution from the source of supply to the customer. The second areas will examine what carrier type is used and what the selection criteria exists for carrier choice. The third area identifies what types of services are offered by the forwarder to customers and identifies services which may be offered to one customer but not necessarily performed for all customers. The fourth area identifies the same information about facilities provided to the customers. The last area asks freight forwarders perceptions on types of services and facilities they feel are most important in an effective international distribution channel. A sample of 13 forwarders will be given the questionnaire before it is produced in final form and to the 126 freight forwarders in this population. Problems of question clarity, definition and omission will be resolved upon return of the sample questionnaires. The sample questionnaire can be found in Appendix A.

Filling out the questionnaire is fairly straightforward. In the first four sections, the questionnaire allows freight forwarders who serve more than one customer to identify customers individually and provide responses for each. This will allow a single forwarder to identify individual differences among or between multiple customers. Section five asks for forwarder perceptions of the significance of both functions and facilities which they

feel would contribute to effectiveness of the distribution services they provide. Questions in the first four sections of the questionnaire are to be marked using nominal scaling methods while the final section uses interval scaling for data collection purposes.

Table 8 shows the relationship between the questionnaire and the hypotheses. No hypotheses are offered for the last section as it will be used only to measure perceptions of what forwarders feel should be included in their operations to gain maximum effectiveness.

Statistical Testing of Hypotheses: The basic tests for hypotheses 1 through 12 will use Analysis of Variance procedures. Individual tests between or among groups will use one or a combination of recognized⁶ significance testing measures. The decision of which test is most appropriate to use will depend upon the question, the response rate, and the specific application of the testing device. Since all hypotheses tests will be performed using normal Statistical Package for the Social Sciences (SPSS) programs, the actual printouts will not be included in this document. The specific test used will be identified with each hypothesis.

Testing for the last hypothesis will use multiple linear regression techniques to determine if a predictive model can be defined using the 12 research variables above. The stepwise multiple regression technique is used as a predictive technique to determine which variables account

ENDNOTES

1. See Appendix D.
2. Glen C. Walters, Marketing Channels (Goodyear Publishing Co., Santa Monica, CA., 1977), p. 173.
3. For example, see James C. Johnson and Donald F. Wood, Contemporary Physical Distribution & Logistics (Penn Well Books, Tulsa, OK, 1982), pp. 449-451 or Warren J. Keegan, Multinational Marketing Management (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1980), p. 434.
4. See Appendix D.
5. Philip R. Cateora, International Marketing (Richard D. Irwin, Inc., Homewood, Illinois, 1982), pp. 315-321.
6. For example, see Jerome L. Myers, Fundamentals of Experimental Design (Allyn and Bacon, Inc., Boston, MA., 1979).

CHAPTER IV
ANALYSIS OF DATA AND FINDINGS

Overview

The analysis of the data collected about the operations of freight forwarders in a specified international logistics channel and the results of the hypothesis tests set forth in Chapter I are presented in this chapter. The original purpose of this research was to determine if there were identifiable factors or variables which could be used to predict the level of service that a freight forwarder would provide. The measure of service was arbitrarily set as a measure of the amount of material loss in the distribution channel in relation to the total volume of material shipped through that channel. In addition to supplying data to answer the research questions, the freight forwarders provided additional data which further helped to understand forwarder activities. This additional information will be included with the rest of the findings.

This chapter will respond to several questions by examining the operations of freight forwarders as reported by them in the questionnaires returned in early January 1986. Additionally, data on shipments through particular international distribution channels were obtained for each

forwarder through an independent source for all forwarders. In total, three sets of data, identified in the next section, below, were collected and used in the analysis for this study.

The remainder of this chapter will include the following major areas: 1) a review and analysis of the proposed methodology giving the results of individual tests; 2) a description of the data bases used in the analyses; 3) an analysis of the questionnaire used as one of the data collection tools; 4) the demographic data on the freight forwarder sample used in the analysis; 4) the results of the hypothesis testing; 5) illustrate the need and give the rationale for further testing of the data; 6) outline the plan for additional analyses, and; 7) end with the predictive model for classification of freight forwarders resulting from the analyses.

Analysis of the Data

Two separate, but related, data sets were obtained from the International Logistics Center. One set identified the number of Report of Discrepancies (RODS) for all freight forwarders doing business with the United States Air Force Security Assistance Program. The time period used in this data base was Fiscal Year 1985 (1 October 1984 to 30 September 1985). The data system used to collect this information was an IBM System 38. The decision algorithm

was simply to identify the freight forwarder and to count the number of RODS. The program for to gather data for this part of the data is found in Appendix E. Only RODS of two types were considered: (1) a report of a loss/non-receipt and (2) a shipment that was received short. Rationale for including only these two types of RODS is found in Chapter III.

The second data base determined the volume of shipments for each freight forwarder. The time period used in this data base was FY 1985. These data were stored on an IBM 3083JX system. Again, the decision criteria was merely a count of all shipments through each freight forwarder for the time period specified.

Because of the complicated nature of Security Assistance shipments, several decision criteria had to be applied to the data collection algorithm. Appendix F identifies the decision criteria for the IBM 3083JX program. After execution of that program, the results of the first two data bases were manually combined. Forwarder data from both data bases were paired for shipment volume and number of RODS submitted so that an index could be established. This index was described in Chapter III.

The third data base was established through questionnaires sent to two groups of freight forwarders. Seventy-seven questionnaires were sent to each of the forwarders who were identified by the ILC data base as

having at least one ROD in FY 1985. Thirty questionnaires were sent to forwarders who were identified in the second data base but who were not identified as having RODS during that reporting period. The questionnaire was pretested on 13 forwarders to determine if the data gathering instrument was understandable and if it would provide the correct information for analysis. Eight of the 13 forwarders returned the pretest questionnaire. None had any problems understanding or filling out the questionnaire. One forwarder refused to participate in the test stating he felt this was proprietary data and that it should not be released.

Description of the Data

The International Logistics Center data showed that there was a total of 551,836 shipments to foreign countries through international freight forwarders during the period 1 October 1984 through 30 September 1985. The value of those shipments was \$910,212,608.00. While the number of shipments lost or short was just over 1 percent of all shipments it was almost 3 percent of the total dollar value of all shipments. Such occurrence would indicate that the majority of RODS submitted are for the larger dollar value items. Although the number of RODS submitted may seem small in number, it represents almost 24 million dollars of material lost somewhere in the system. The loss of Security

Assistance material can significantly impact the combat readiness of American forces and allies worldwide. Reduction of these losses and improved channel effectiveness can, and should, result in tremendous financial savings to the American taxpayer.

Analysis of the Questionnaire

The 31 usable questionnaires provided valuable information and insight to the population of freight forwarders. Much of the data collected is descriptive in nature and some was used in conjunction with the other two data bases for statistical analysis and hypothesis testing which will be presented later in this chapter.

Forwarder Demographics

Thirty-four freight forwarders responded to the questionnaire sent in January 1986, of which only 31 were usable for analysis. As a group they had functioned as freight forwarders for an average of over 32 years, however, their experience ranged from a high of 110 years to a minimum of 5 years. The average time they had provided forwarder services for their particular country or countries was 9.5 years. This range was significantly less having a maximum of 40 years to a minimum of only 1 year. Most of those responding (22) serviced only one country; however, one forwarder provided services for six countries. The group average was 1.09 countries per forwarder.

Distribution Channel Operations

One set of data on the questionnaire concerned operations within the forwarder's specific distribution channel. Thirty-one questionnaires were usable in this section. The first series of questions asked about communication links within the channel. It was found that almost 60 percent of those responding received notice of availability of material to be sent to them through the normal United States mail system. Only two firms (6.45 %) exclusively used electronic means (TELEX) for notification of shipments to their locations. Two firms used a combination of mail and TELEX while three firms used a combination of mail and regular telephone for notification. Four firms did not usually receive notification of shipment availability prior to actually receiving the item(s) at their operating location.

Over 70 percent (22 firms) received the notification of availability from the United States Air Force. Three firms (9.68%) received notification from foreign government personnel residing outside the United States. Only three firms reported being notified of shipment availability by more than one source.

Firms used slightly different communication modes to notify their customers of items available for shipment. Only 6 firms (19.35%) reported notifying their customers exclusively by mail service while 11 firms (35.48%) used

only TELEX transmissions to notify their customers. Twelve firms (38.71%) used a combination of mail services plus another mode of communication; the most common mode being TELEX transmissions.

Forwarders were almost evenly split regarding when notification was made to their customers. Thirteen (41.94%) notified customers after shipment had been made while twelve forwarders (38.71%) notified customers before shipment took place. Five forwarders (16.94%) marked both responses indicating they were notified sometimes before and sometimes after the shipment actually was accomplished. One forwarder indicated they did not notify the customer either before or after shipment.

All thirty-one freight forwarders received material from the United States Air Force and other sources. None received material from a single source only. Looking at the other end of the channel, three forwarders (9.68%) received shipments for the foreign air force only; fourteen (45.16%) received shipments for foreign air forces and other military services of the country; and fourteen forwarders received material for foreign services and commercial businesses in the foreign country.

When asked about the length of time material stayed in the freight forwarder's facilities, only 13.33 percent (4 forwarders) reported keeping material more than two working weeks. Fifty percent indicated they kept material from

between one and two working weeks. Only 3 forwarders (10%) indicated they kept material less than five working days. Six forwarders indicated that the length of time material was held was determined by the priority of the shipment where high priority shipments moved out under 5 working days and routine shipments were passed through the facility within two working weeks.

There was no consensus among forwarder's decision criteria for onward shipment of material. More than 26 percent of the forwarders indicated they used more than one decision rule when determining when and how to ship to their customers. Six forwarders indicated the customer dictated the shipment mode. The remaining categories were fairly evenly split among the freight forwarders. Responses revealed the following: shipments were held for consolidation (16.67%), shipments were held for scheduled transportation (16.67%), shipments were sent on first available transportation (10.00%), shipments were held for a specific transportation mode (6.67%).

More than half of the freight forwarders surveyed indicated they shipped to a single port of entry in the foreign country. Thirteen forwarders (43.33%) shipped to multiple ports of entry. The maximum number of ports of entry for any forwarder was six; the minimum number of ports of entry was two.

Half of the countries responding indicated that between zero and 25 percent of their business was attributed to Security Assistance. Forty percent (12 forwarders) reported that Security Assistance accounted for more than 75 percent of their business. The remaining three forwarders indicated that between 26 and 75 percent of their business was strictly with Security Assistance material. The average of all responses indicated that Security Assistance material accounted for 41.83 percent of these forwarder's workload.

Part of the questionnaire was designed to gain insight about how shipments were sent. The vast majority (73.33%) sent less than 25 percent of their shipments by air. Ninety percent of the forwarders shipped less than half of their shipments by air. Only three forwarders indicated they shipped between 75 and 100 percent of their shipments by air transportation. The average of all responses reveals that only 23.17 percent of freight forwarder material is sent by air transportation.

An average of 45.00 percent of all freight forwarder's material travels by foreign flag carriers. Twelve carriers (40.00%) reported using foreign flag carriers less than 25 percent of the time. Three forwarders reported using no foreign flag carriers while only one forwarder used foreign flag carriers for 100 percent of their shipments.

Carrier Selection

To determine the importance of factors used by freight forwarders in selecting a shipment mode (air or sea) to be used for onward transportation of material to the foreign country, a Likert-type scale was used. Responses were then tallied and assigned weighting according to the response made. If the number one response was selected it was assigned 5 points, choice number 2 was assigned four points, choice 3 assigned three points, choice 4 was assigned two points and if choice 5 was selected it was assigned one point. Table 9 lists the results of this section of the questionnaire. The dominate criterion for selection of carrier mode was the "priority of the shipment". This was followed by "reliability of service".

Another section of the questionnaire dealt with identifying the importance of criteria used in selecting a specific carrier among all carriers of the same mode. Again a Likert-type scale was used, tallied, and weighted according to the same assignment factors as listed above. Table 10 shows the results of these criteria. The dominate criteria were again "priority of the shipment" followed by "reliability of service".

TABLE 9
SELECTION OF CARRIER MODE FOR FOLLOW-ON SHIPMENT

RANK	CRITERIA	SCORE
1	Priority of shipment	121
2	Reliability of service	114
3	Freight damage or loss record of carrier	110
4	Carrier choice directed by country	105*
5	Carrier reputation	103
5	Transit time of carrier	103
6	Special handling requirements	102
7	Frequency of service	99
8	Past experience with carrier	98
8	Foreign ports served by carrier	98
9	Freight rate charges	92

Highest possible score would be 135 if all forwarders marked the highest rating block. (5 times 27 responses=135).

* NOTE: All scores are based on 27 usable questionnaires except for "Carrier choice directed by country". Thirty forwarders marked that response in one of the five categories giving it an overall score of 117. The adjusted score based on 27 responses was 105 and is shown in the appropriate position in the table. ($117 \times 27/30 = 105$)

TABLE 10
SELECTION OF SPECIFIC CARRIER FOR FOLLOW-ON SHIPMENT

RANK	CRITERIA	SCORE
1	Priority of shipment	122
2	Reliability of service	111
3	Frequency of service	108
4	Transit time of carrier	105
5	Freight damage or loss record of carrier	104
6	Carrier choice directed by country	102*
7	Carrier reputation	100
8	Past experience with carrier	99
8	Foreign ports served by carrier	99
9	Special handling requirements	98
10	Freight rate charges	92

Highest possible score would be 135 if all forwarders marked the highest rating block. (5 times 27 responses=135).

* NOTE: All scores are based on 27 usable questionnaires except for "Carrier choice directed by country". Thirty forwarders marked that response in one of the five categories giving it an overall score of 113. The adjusted score based on 27 responses was 102 and is shown in the appropriate position in the table. ($113 \times 27/30 = 102$)

Services Provided

A portion of the questionnaire was designed to determine the kinds of services provided by freight forwarders. Thirty-one questionnaires were usable for this section. The results are shown in Table 11.

Forwarder Facilities

Questionnaire results also revealed information about the physical facilities and capacities of the forwarder operations. Thirty-one usable responses are included in this data. The average amount of warehouse space dedicated to Security Assistance material for all respondents was 2161 square feet. This ranged from 7 forwarders who provided less than 1,000 square feet to 11 forwarders who provided more than 10,000 square feet of storage space. Thirteen forwarders provided between 1,000 and 10,000 square feet of storage space.

Over ninety percent of the freight forwarders employed fewer than 25 people to deal with Security Assistance shipments. Only three forwarders used between 25 and 100 employees for these tasks. The average forwarder employed 15.97 persons strictly for Security Assistance material.

All freight forwarders who serviced more than one country provided separate and segregated storage space for each country. Twenty-seven forwarders (87.09%) provided secure storage for pilferable items but only ten forwarders

TABLE 11
FREIGHT FORWARDER SERVICES PROVIDED

TYPE OF SERVICE	NUMBER RESPONDING	PERCENT
Provide warehouse and storage space	31	100.00
Make transportation arrangements	31	100.00
Provide containerized shipment service	30	96.77
Provide tracer action on missing shipments	29	93.55
Obtain customs clearances	28	90.32
Consolidate material for follow-on shipment	28	90.32
Provide consolidated bill of lading	27	87.09
Handle return of reparable material in reverse distribution flow	27	87.09
Initiate claims filing paperwork	26	83.87
Provide additional processing or packaging of material for follow-on shipment	26	83.87
Provide financial services (payments for goods)	26	83.87
Obtain export licenses	21	67.74
Provide for pilot pickup (foreign air force) of material when requested	17	54.84
Provide notice of availability to country	16	51.61
Inspect material upon receipt at facility	16	51.61
Obtain insurance for material	15	48.39
Initiate reports of discrepancy (DD Form 364)	11	35.48

NOTE: Percent is number of forwarders responding that they provided that service. 31 of 31=100%; 11 of 31=35.48%.

(32.26%) provided facilities for controlled storage of temperature or humidity sensitive items.

Only four forwarders (12.91%) performed inspection on inbound material. Of those, inspection was only accomplished on less than 10 percent of all material. Two forwarders inspected less than 5 percent and two forwarders inspected between 5 and 10 percent of all inbound material.

Freight Forwarder Perceptions

A section of the questionnaire was designed to record how forwarders felt about the importance of services they could provide to their customers. Forwarders were to assume an open-ended contract and rank criterion according to its perceived importance to an effective forwarding operation. A Likert-type scale, like the one described earlier, was used to record responses. Results of thirty usable questionnaires are shown in Table 12. The last section of the questionnaire recorded forwarder feelings of facility requirements provided to their customers. The results of those forwarder perceptions are shown in Table 13. Both tables indicate the relative importance of services forwarders could provide to their customers. Stated differently, these tables show what services the forwarders feel should be provided to their customers in order to be effective.

TABLE 12
FORWARDER PERCEPTIONS OF THE IMPORTANCE OF SERVICES

RANK	SERVICE	SCORE
1	Provide warehouse and storage space	141
2	Make transportation arrangements	140
3	Obtain customs clearances	136
4	Obtain export licenses	126
5	Provide containerized shipment	125
6	Consolidate material for follow-on shipment	120
7	Provide tracer action on missing shipments	121
8	Handle return of reparable material	119
9	Provide consolidated bill of lading to country	116
10	Provide notice of availability to country	112
10	Provide financial services (payments)	112
11	Initiate claims filing paperwork	107
12	Provide additional processing or packing	100
13	Obtain insurance for material	91
13	Inspect material upon receipt at facility	91
14	Provide for pilot pickup (foreign air force)	83
15	Initiate Reports of Discrepancy (DD Form 364)	82

OTHER RESPONSES

Computerized information on shipment data (2 responses)

Rate negotiation (1 response)

Quick notification capability to country (1 response)

NOTE: Highest possible score would be 155 if all forwarders marked the highest rating block. (5 times 31 responses=155).

TABLE 13
FORWARDER PERCEPTIONS OF THE IMPORTANCE OF FACILITIES

<u>RANK</u>	<u>CAPABILITY</u>	<u>SCORE</u>
1	Adequate personnel to perform each function	141
2	Adequate warehouse space	137
3	Secure storage area for pilferable items	130
4	Separate storage areas for each country program	115
5	Separate personnel for each country program	90
6	Controlled storage facilities	77
OTHER RESPONSES		

Computerized shipment tracking capabilities (2 responses)
Computer links to supplier and/or country (2 responses)

NOTE: Highest possible score would be 155 if all forwarders marked the highest rating block. (5 times 31 responses=155).

Results of Hypotheses Testing

The original hypotheses noted in Chapter III represent an estimation of prudent hypotheses based on initial perceptions of forwarder operations. It became obvious upon return of the questionnaires that some of the categories and criteria for measurement of forwarder operations were not highly relevant while other categories included more options than originally considered. For example, in the first hypothesis only one forwarder responding indicated they used Dataphone for transmission of requisition status to their customer. Therefore, in addition to the original hypothesis testing, additional categories were sometimes included in subsequent analyses. The additional hypotheses will be identified with an "A" suffix and noted after analysis of the original hypotheses. The original theses and the related hypotheses, stated in null form, are listed below.

Thesis 1: The type of data transmission affects material loss.

H1.1: There are no significant differences in material loss between requisitions submitted by mail and those submitted by TELEX.

H1.2: There are no significant differences in material loss between requisitions submitted by TELEX and those submitted by Dataphone.

H1.3: There are no significant differences in material loss between requisitions submitted by Dataphone and those submitted by mail.

Additional hypotheses for Thesis 1:

H1.4A: There are no significant differences in material loss between forwarders who receive requisition status submitted by mail and those received by other means (TELEX, Dataphone).

H1.5A: There are no significant differences in material loss between requisition status submitted by mail only and those submitted by mail and another means.

Originally it was expected that the type of data transmission was responsible for losses of material in the distribution channel. To test this thesis, the type of data transmission was divided into six groups. Group one was informed of a shipment to them by means of U.S. mail. Group two was notified by TELEX. Group three was notified by Dataphone. Group four was notified by regular telephone. Group five stated they were not informed prior to shipment of the item. Group six was a combined group which used mail and at least one other means of data transmission. A one-way analysis of variance (ANOVA) was run on each of the groups against their composite score of effectiveness. The results of the ANOVA showed only one group to have any significant differences at the .05 or lower level of significance. The analysis showed a significance at the .001 level between forwarders who used TELEX and those forwarders who were not informed (groups 2 and 5). One could therefore conclude that there is a significant difference in the amount of material loss between forwarders

who are informed of shipment availability by TELEX and those forwarders who are not informed of shipments.

Since the ANOVA tests for all categories fails to prove significance at the .05 level (except as noted above), Hypothesis 1.4A is accepted and it is concluded that the type of data transmission does not affect material loss. However, since there was a significant difference between forwarders who were notified by TELEX and those who did not receive notification, it can be concluded that notification by TELEX as opposed to no notification does affect the amount of material lost in a distribution channel.

Hypothesis 1.5A must also be accepted since the ANOVA did not show any significant differences between forwarders who used mail exclusively and those forwarders who used mail plus some other type of data transmission. Therefore, it can be conclude that there is no significant difference in material loss between these two groups of freight forwarders.

The results of the ANOVA for all categories are shown in Table 14. The categories, their level of significance and the determination of acceptance or rejection are given.

TABLE 14

RESULTS OF ANOVA FOR TYPE OF DATA TRANSMISSION

GROUP	NAME	SIGNIFICANCE LEVEL	ACCEPT OR REJECT
1-6	MAIL TO MAIL PLUS OTHER	.556	ACCEPT
1-2	MAIL TO TELEX	.617	ACCEPT
1-4	MAIL TO TELEPHONE	.839	ACCEPT
1-5	MAIL TO NOT INFORMED	.838	ACCEPT
2-4	TELEX TO TELEPHONE	.768	ACCEPT
2-5	TELEX TO NOT INFORMED	.000	REJECT
2-6	TELEX TO MAIL PLUS OTHER	.843	ACCEPT
4-6	TELEPHONE TO MAIL PLUS OTHER	.717	ACCEPT
4-5	TELEPHONE TO NOT INFORMED	.664	ACCEPT
5-6	NOT INFORMED TO MAIL PLUS OTHER	.456	ACCEPT

Thesis 2: The type of data information flow affects material loss.

H2.1: There are no significant differences in loss between information flows of Type 1 (customer-freight forwarder) and those of Type 2 (producer-freight forwarder-customer).

H2.2: There are no significant differences in material loss between information flows of Type 2 and those of Type 3 (producer-freight forwarder only).

H2.3: There are no significant differences in material loss between information flows of Type 1 and Type 3.

Results of the survey revealed that all forwarders sent notification to their customers (Type 2). Further, no forwarder responded as using a Type 3 information flow. Hence, no ANOVA could be accomplished since there were at least one empty cell in the analysis. However, two distinct groups could be formed based upon whether they received information about a shipment before or after shipment occurred. Therefore, the following hypothesis was tested:

H2.4A: There are no significant differences in material loss between those forwarders who notify countries before shipment is made and those who notify countries of a shipment after the shipment has occurred.

Analysis of Variance procedures were used to determine if there were significant differences between the notification procedures used by freight forwarders to inform their customers of a shipment to them. Three groups were

tested: group one notified customers in advance of shipment; group two informed the customer after actual shipment of the goods; group three stated they informed their customers of shipment both before and after the shipment took place. The results of these ANOVA tests indicated that there are no significant differences observed at the .05 level.

Therefore, Hypothesis 2.4A must be accepted and it can be concluded there is no significant difference between forwarders who inform customers before or after shipment of material takes place. Summary data are shown in Table 15.

Thesis 3: The amount of inspection done by the freight forwarder affects material loss.

H3.1: There are no significant differences in material loss between freight forwarders performing less than 5 percent inspection of all goods and freight forwarders performing at least 5 percent inspection upon receipt of material at their operating location.

The next hypothesis to be tested dealt with the amount of inspection performed by the freight forwarders. Two groups were formed: group one performed less than 5 percent inspection on all received shipments; group two inspected at least 5 percent of all shipments. Group one consisted of 27 freight forwarders while group two had only 4 forwarders. The analysis showed the value of F as .325 which is significant at the .573 level. Since the results of the ANOVA indicated there was no significant differences between

the two groups at the .05 level, the hypothesis that there are no significant differences between forwarders who inspect inbound material and those forwarders who do not perform inspection must be accepted. The SPSSx output of ANOVA results are found in Table 15.

Thesis 4: The consolidation policy of the freight forwarder affects material loss.

H4.1 There are no significant differences in material loss in full consolidated shipments and individual shipments, i.e., those in less than full containers.

H4.2: There are no significant differences in material loss in consolidated shipments from a single producer and those shipments made of mixed (several producer's) shipments.

H4.3: When shipments are consolidated, there are no significant differences in material loss between forwarders who provide a new Bill of Lading and forwarders who do not provide a new consolidated Bill of Lading to their customers.

The questionnaires revealed that all forwarders use consolidation as a standard business practice. Additionally, all forwarders reported they received shipments from multiple producers. Finally, all stated that they provided a new consolidated Bill of Lading if the shipment was consolidated. Therefore, since all forwarders were in the same category in this area, no analysis could be performed since ANOVA requires at least two groups for analysis.

Thesis 5: Shipment to more than one Port of Entry (POE) affects material loss.

H5.1: there are no significant differences in material loss between shipments to a single POE and shipments to multiple POE's.

The next area of analysis was for forwarders who shipped to one or more than one port of entry in the foreign country. Two groups were formed: group one consisted of 18 forwarders who shipped to only one POE; group two consisted of 13 forwarders who shipped to more than one POE. The ANOVA showed the F value as .629 which is significant at the .434 level. Since no significant differences were evident at the .05 level the hypothesis must be accepted and it must be concluded that there are no significant differences between forwarders who ship to only one POE and those who ship to multiple POE's. Summary data of ANOVA are found in Table 15.

Thesis 6: The type of carrier affects the amount of material loss.

H6.1: There are no significant differences in material loss between air and water carrier transportation.

H6.2: There are no significant differences in material loss between foreign flag carriers and United States flag carriers.

All carriers reported that they used both air and water transportation modes of transportation. However, upon examination of the questionnaires, it was apparent that some

forwarders used one mode much more than another. Therefore, two groups of forwarders were formed using the percentage of air freight as the decision criteria. Additionally, all forwarders reported they used a combination of domestic and foreign flag carriers for shipment. Again, two groups were formed using the percentage of foreign flag carriers used as the decision criteria. The following two hypotheses were formed:

H6.3A: There are no significant differences in material loss between forwarders who send less than 25 percent of their material by air and those who send more than 25 percent of their shipments by air.

H6.4A: There are no significant differences in material loss between forwarders who send less than 25 percent of their shipments by foreign flag carrier and those who ship more than 25 percent of their material by foreign flag carriers.

Thesis 6 looked at differences in forwarders who shipped by air versus sea modes and those who shipped by foreign flag carriers and those using domestic carriers. For hypothesis 6.4A, two groups were formed: group one contained 23 forwarders who shipped less than 25 percent of their shipments by air; group two had 8 forwarders who shipped at least 25 percent of their shipments by air transportation. ANOVA did not show significant differences between the two groups at the .05 level. The F value for these two groups was .678 which is significant at the .417 level. Summary data of ANOVA are shown in Table 15.

The last hypothesis in this area looked for differences between forwarders who shipped by domestic or foreign flag carriers. Group one consisted of 13 carriers who shipped less than 25 percent of their material by foreign flag carriers; group two consisted of 18 carriers who shipped 25 percent or more by foreign flag carriers. Again, the results of the analysis of variance tests did not show significance at the .05 level. The F value for these two groups was 1.313 which is significant at the .261 level, therefore it must be concluded that there is no significant difference in material loss between forwarders who ship less than 25 percent of their goods by foreign flag carriers and those forwarders who use foreign flag carriers for at least 25 percent of their shipments. Results of the SPSSx program can be seen in Table 15.

Thesis 7: The volume of traffic to a customer affects material loss.

H7.1: There is no significant relationship between material loss and the dollar value of those shipments.

H7.2: There is no significant relationship between material loss and the number of shipments through a freight forwarder.

H7.3: There are no significant differences in material loss between forwarders who have less than 20 per cent of their business with the U.S. Air Force and those with between 21 and 50 per cent of their business with the U.S. Air Force Security Assistance Program.

H7.4: There are no significant differences in material loss between forwarders who have between 21 and 50 percent of their business with the U.S. Air Force and those with greater than 50 per cent.

H7.5: There are no significant differences in material loss between forwarders who have less than 20 per cent of their business with the U.S. Air Force and those with greater than 50 per cent of their business with the U.S. Air Force Security Assistance Program.

Since no forwarder reported having over 50 per cent of their business attributed to the U.S. Air Force Security Assistance Program, the two larger percentage categories were combined to form a new hypothesis group for testing.

H7.6A: There are no significant differences in material loss between forwarders who do less than 25 percent of their business with the U.S. Air Force Security Assistance Program and those who have 25 percent or more of their business with the Air Force.

Thesis 7 looked at value, volume and percentage of business in relationship to material loss in a distribution channel. Data obtained from the International Logistics Center was used for the first two analyses. There were 57 forwarders included in the analyses of these data. For Hypothesis 7.1, material loss was compared to the dollar value of all shipments through each freight forwarder. A nonparametric correlation was performed between the material loss and the dollar value of all shipments through the freight forwarder. The Spearman rank order correlation showed that there is a positive and significant (at the .002

level) relationship between the shipment value. Therefore, the hypothesis that there is no significant difference between material loss and value of shipments through a freight forwarder must be rejected.

The second area of analysis determined that there was a positive and significant (at the .000 level) linear relationship between material loss and the number of shipments through a freight forwarder. Since the Spearman rank order correlation was significant, the hypothesis that there is no relationship between shipment volume and material loss must be rejected.

These two tests seem intuitive since the more shipments through a freight forwarder should account for greater dollar value of such shipments and both increased value and volume should lead to more losses in the channel.

The last area in this group tested if the amount of business Security Assistance represented as a percent of total business of the freight forwarder accounted for differences in material loss. Two groups were again tested: group one consisted of 15 forwarders who had less than 25 percent of their business dealing with Security Assistance; group two had 16 forwarders who had more than 25 percent of their business resulting from Security Assistance activities. The results of the ANOVA showed no significant differences between the two groups at the .05 level. The value of F was .788 which is significant at the .382 level,

meaning the hypothesis that the amount of Security Assistance business does not account for differences in material loss between these two groups of freight forwarders must be accepted.

The next hypotheses dealt with the physical facilities of the freight forwarders.

Thesis 8: The facilities provided by the freight forwarder affect material loss.

H8.1: There are no significant differences in material loss between full service and less-than-full service freight forwarders.*

* forwarders will be categorized depending upon physical facility capabilities (storage capacity, security availability, materials handling capability, separation capabilities, etc.) according to answers provided to the questionnaires.

The original hypothesis was exploratory in nature. As such, the categories were made after the questionnaires were returned. The resulting hypotheses substitute for the original one and are listed below:

H8.2A: There are no significant differences in material loss between forwarders who provide more than 5000 square feet of storage space and those who provide less than 5000 square feet of storage space. (The average of all responses was equal to 2161.29 square feet).

H8.3A: There are no significant differences in material loss between forwarders who provide secure storage space and those forwarders who do not provide secure storage space.

H8.4A: There are no significant differences in material loss between forwarders who employ at least 25 personnel and those who employ less than 25 personnel.

To test the first hypothesis, forwarders were divided into two groups: group one consisted of 17 forwarders who provided less than 5000 square feet of storage space; group two contained 15 forwarders who provided at least 5000 square feet. The ANOVA showed an F value of 1.565 with a significance of .221. Thus, the hypothesis that the amount of storage space provided by these two groups of forwarders affects material loss must be accepted.

Next, forwarders who provided secure storage were tested against those forwarders who did not provide secure storage. Group one had only 4 forwarders who provided secure storage while group two consisted of 27 forwarders. The ANOVA results showed an F value of .319 which is significant at the .577 level. The hypothesis that there are no significant differences in material loss between forwarders who provide secure storage and those forwarders who do not must be accepted.

The last area tested under facilities dealt with the number of employees at the forwarder location. Group one consisted of 28 forwarders who employed 25 people or less while group two had 3 forwarders who had more than 25 employees. The results of ANOVA testing gave an F value of .055 which is significant at the .816 level. The hypothesis must be accepted and it can be concluded that the number of employees does not make a significant difference in the amount of material loss for these freight forwarders.

Thesis 9: The presence of a customer representative in the United States affects material loss.

H9.1 There are no significant differences in material loss between customers who have a representative in the United States and those customers who have no such representation.

The presence of a representative within the United States was tested to determine if having such a person would affect the material loss in that distribution channel. Of the 57 forwarders tested 35 had representatives in the U.S. A correlation was run between the two groups against the amount of material loss. The Spearman correlation coefficient showed $-.0986$ indicating that there was a negative correlation significant at the $.233$ level. The hypothesis that there is no significant difference in material loss between customers who have a representative and those who do not have a representative in the U.S. must be accepted.

Thesis 10: Performing as an exclusive freight forwarder affects material loss.

H10.1: There are no significant differences in material loss between freight forwarders handling only one customer and those serving multiple customers.

H10.2: There are no significant differences in material loss between freight forwarders handling only a single producer's material and those forwarders handling more than one producer's material.

Since all forwarders reported handling multiple producer's materials, Hypothesis 10.2 could not be tested. However, it was possible to classify forwarders into two groups depending upon whether they shipped to only military or military and civilian customers in the foreign country. Therefore, the following hypothesis was constructed and tested:

H10.3A: There are no significant differences in material loss between freight forwarders handling only shipments to foreign military customers and those forwarders shipping to both military and civilian customers in the foreign country.

To test Hypothesis 10.1 forwarders were again divided into two groups: the first group contained 22 forwarders which served only one country; group two consisted of 9 forwarders who served more than one country. The range of the second group was from 2 to 6 different countries with the mean being 1.548 countries for each forwarder. The ANOVA showed there were no significant differences between the two groups. The F value was .137 and that was significant at the .714 level. The hypothesis must be accepted and it can be concluded that there is no significant difference between forwarders who service one country and those which serve multiple customers.

To test whether servicing more than one type of customer made a difference in the forwarder operations, two groups were established: the first group contained 17 forwarders

who served only one country; the second group consisted of 14 forwarders who served multiple customers (countries). The results of the ANOVA indicated there was again no significant differences between the two groups. An F value of .577 was obtained which is significant at the .454 level. Again this hypothesis must be accepted and it can be concluded that there is no significant difference between forwarders who service only foreign military customers and those forwarders who serve both military and civilian businesses. Results of these two hypotheses tests may be found in Table 15.

Thesis 11: Flow times through the freight forwarder affects material loss.

H11.1: There are no significant differences in material loss between freight forwarders whose flow time is less than or equal to 5 days and those forwarders whose flow time is greater than 5 days.

Hypothesis 11.1 was used to determine if there was a difference between forwarders based upon the amount of time it took for material to be processed through their facilities. Two groups were formed: group one consisted of 19 forwarders who reported material moved through their facility in more than 5 days; group two consisted of 12 forwarders who took 5 working days or less to process material through their work areas. An ANOVA was performed on the two groups. The results showed an F value of .649 which was significant at the .427 level. From this the

hypothesis must be accepted and it can be concluded that there are no significant differences between these two groups of freight forwarders which would account for material loss based upon the flow time through the forwarder facility. Results of the ANOVA can be found in Table 15.

Thesis 12: The economic development of a country affects material loss.

H12.1: There are no significant differences in material loss between developed countries and developing countries.

The last hypothesis dealt with the determining if the degree of economic development may explain differences in the amount of material loss in this distribution channel. Two groups were formed based upon their classification by the Organization for Economic Cooperation and Development (OECD). Group one contained 31 forwarders contractually bound to economically developed countries. Group two contained 26 forwarders linked to developing nations. A Spearman correlation was performed between the two groups and gave a Spearman correlation of $-.0921$ with a level of significance of $.248$. This would indicate that the more advanced, or economically developed countries tend to lose less material. However, due to the weak correlation and the level of significance, the null hypothesis must be accepted and it can be concluded that the economic development of the

country does not account for differences in material loss for these forwarders.

The results of all hypothesis tests are shown in Table 16.

TABLE 15
SUMMARY OF ANOVA TESTING

VARIABLE TO SCORE	VALUE OF F	SIGNIFICANCE OF F
DATAx	0.767	0.556
MILCIV	0.019	0.454
NOTIFY	0.705	0.502
FLOW	0.649	0.427
POE	0.629	0.434
MODE	0.678	0.417
FLAG	1.131	0.216
SAB	0.788	0.382
STO	1.565	0.221
EMP	0.055	0.816
INSP	0.325	0.573
SECS	0.319	0.577
YIB	1.149	0.293
YWC	0.208	0.652
NOC	0.137	0.714

NOTE: This is an SPSSx Analysis of Variance Program.

SUMMARY OF HYPOTHESES TESTING

HYPOTHESIS	AREA	RESULTS
H1.1	Type of Data Transmission	Accept
H1.2	Mail Versus All Other Data Transmission	Accept
H2.1	Type 1 and Type 2 Notification	Not Testable
H2.2	Type 2 and Type 3 Notification	Not Testable
H2.3	Type 1 and Type 3 Notification	Not Testable
H2.4A	Notify Before or After Shipment	Accept
H3.1	Amount of inspection	Accept
H4.1	Consolidation vs. Individual Shipments	Not Testable
H4.2	Ship Single vs. Multiple Producers	Not Testable
H4.3	No vs. New Bill of Lading	Not Testable
H5.1	One vs. Multiple Ports of Entry	Accept
H6.1	Shipments by Air vs. Water Modes	Not Testable
H6.2	Shipment by Domestic vs. Foreign Flag	Not Testable
H6.3A	Ship More vs. Less Than 25 Percent by Air	Accept
H6.4A	Ship More vs. Less Than 25 Percent by Foreign Flag	Accept
H7.1	Material Loss and Dollar Value	REJECT
H7.2	Material Loss and Shipment Volume	REJECT
H7.3	Less Than .2 vs. >.2<.5 Business with USAF	Not Testable
H7.4	Between .21 and .5 vs.>.5 Percent with USAF	Not Testable
H7.5	Less Than .2 vs. >.5 Percent with USAF	Not Testable
H7.6A	Less Than .25 vs. >.26 Percent with USAF	Accept
H8.1	Full vs. Less-Than-Full Service Forwarder	Not Testable
H8.2A	Less Than 5000 vs. >5000 SqFt Storage	Accept
H8.3A	Secure vs. No Secure Storage	Accept
H8.4A	Employ More vs. Fewer Than 25 Employees	Accept
H9.1	Customer representative vs. None	Accept
H10.1	Services for one/multiple customers	Accept
H10.2	One vs. Multiple Producers	Not Testable
H10.3A	Services for military/civilian customers	Accept
H11.1	Amount of flow time through forwarder	Accept
H12.1	Economic development of country	Accept

Additional Findings

In addition to the hypotheses tests described above two other hypotheses were advanced and tested. First was the test to determine if there were differences between two groups based on the number of years they have been in the freight forwarding business.

Thesis 13: The amount of time a forwarder has been in business affects material loss.

H13.1A: There is no significant difference between forwarders who had been in the business less than 32 years and those who had been in the forwarding business 32 years or longer.

The groups were divided by their mean (32.77 years). There were 18 countries with fewer than 32 years and 13 countries with more than 32 years experience each. The ANOVA test gave an F value of 1.149 which is significant at the .293 level. A correlation analysis showed a Spearman correlation coefficient of .0475 which is significant at the .400 level.

Since neither test proved significant at the .05 level the hypothesis must be accepted and it can be concluded that there is no significant difference in the amount of material loss based on the number of years a company is in the forwarding business. Results of the ANOVA can be found in Table 15. Results of the correlation are found in Table 17.

A second hypothesis was used to determine if the number of years a company had been serving the same customer may

account for the differences in material loss between forwarders. The thesis and hypothesis for this test were:

Thesis: The amount of time a forwarder has served the same country affects material loss.

H14.1A: There is no significant difference between forwarders who served the same country fewer than 10 years and those who had provided service for the same country for 10 years or more.

Two groups were formed separated at the mean (9.48 years) for all forwarders. Twenty-two forwarders had been with the same country for less than 9.48 years. The second group consisted of 9 forwarders who had been with the same country for over 9.48 years. The results of the analysis of variance test showed an F value of .208 which was significant at the .652 level. These two groups also had a Spearman correlation coefficient of .0397 which is significant at the .416 level. Since neither test was significant at the .05 level the hypothesis must be accepted and it can be concluded that there is no significant difference in material loss between these two groups of freight forwarders which is based upon the amount of time the company has been with the country. Results of the ANOVA are in Table 15. Results of the correlation analysis are found in Table 17.

Further Analyses

Analysis of variance procedures were used for most of the hypotheses as noted above. However, among other things, ANOVA assumes that the distribution is normal. To test for this condition, a Chi-square analysis was performed to determine if the variances of the two groups could come from the same population. The results of the Chi-square test show that all variables fall within acceptable ranges, such that, it can be accepted that there are no differences in the variances between the groups. A second test was for normality of the groups according to their means. A T-Test was run on each variable and group. Again, no group could be rejected.

Since the data analysis did not show many significant results using Analysis of Variance on the originally defined variables, more analysis, using different techniques were performed. In addition to the small sample size, it was suspected that another reason for such inconclusive results could be that many of the variables were correlated to one another. If this was the case, combining those variables and forming new variables could produce significant results which could not otherwise be obtained with the original data. The following analyses were performed in order to determine if some variables could be used to predict success or failure in a channel of distribution.

Correlation Between All Original Variables: A Spearman correlation was done using the original 15 variables. It was found that of the 105 combinations of variables, twenty nine percent (29%) were significantly correlated at the .10 or less level. The results of the correlation analysis can be seen in Table 17.

While some of these correlations were interesting in themselves, the overall objective was to determine how to best group the variables so that further testing could be done. As a test to determine how well the original factors could predict group membership as being "good" or "bad" freight forwarders, a discriminant analysis was performed.

Discriminant Analysis: The original 15 variables were used in a discriminant analysis in an attempt to see how well the variables could correctly classify the 31 freight forwarders into their respective groups of "good" or "bad". These two groups were defined as either better (good) or worse (bad) than the mean of the variable "score" (the "loss index"). The analysis showed that by using all 15 variables, the 30 of the 31 forwarders could be correctly classified into the correct group. This equates to being able to correctly classify forwarders into the correct group 96.77 percent of the time. While this is an outstanding rate of classification, using so many variables would not be a useful tool for the logistics manager. Therefore, because of the high degree of correlation shown in the correlation

TABLE 17
 CLASSIFICATION OF DATA
 AND
 SPEARMAN CORRELATIONS

VARIABLE CATEGORY GROUP	VARIABLE NAME	GROUP MEMBERSHIP	CRITERIA FOR CLASSIFICATION	NUMBER IN
FLOW TIME	FLOW	1	<5 DAYS	19
		2	>5 DAYS	12
PORTS OF ENTRY	POE	1	ONE	18
		2	MORE THAN ONE	13
MODE OF SHIPMENT	MODE	1	<25% BY AIR	23
		2	>25% BY AIR	8
TYPE OF CARRIER	FLAG	1	<25% BY FOREIGN	13
		2	>25% BY FOREIGN	18
FACILITY STORAGE	STO	1	<5000	17
		2	>5000	14
FACILITY EMPLOYEES	EMP	1	<25	28
		2	>25	3
AMOUNT OF INSPECTION	INSP	1	<5%	27
		2	>5%	4
SECURE STORAGE	SECS	1	NO	4
		2	YES	27
TYPE OF DATA TRANSMISSION	DATA X	1	MAIL	18
		2	TELEX	2
		3	DATAPHONE	0
		4	REG PHONE	1
		5	NOT INFORM	4
		6	MAIL PLUS	6
HOW NOTIFI- CATION IS MADE TO COUNTRY	NOTIFY	1	BEFORE	12
		2	AFTER	13
		3	BOTH	5

TABLE 17 (CONTINUED)

VARIABLE CATEGORY GROUP	VARIABLE NAME	GROUP MEMBERSHIP	CRITERIA FOR CLASSIFICATION	NUMBER IN
AMOUNT OF MILITARY BUSINESS	MILCIV	1	MIL ONLY	17
		2	MIL AND CIV	14
AMOUNT OF USAF BUSINESS	SAB	1	<25%	15
		2	>25%	16
AMOUNT OF EXPERIENCE	YIB	1	<32	13
		2	>32	18
YEARS WITH COUNTRY	YWC	1	<9	22
		2	>9	9
NUMBER OF COUNTRIES	NOC	1	ONE	22
		2	MORE THAN 1	9

TABLE 17 (CONTINUED)

SPEARMAN CORRELATIONS
(N=31)

MILCIV	-.1016				
	SIG .293				
NOTIFY	.0276	-.1561			
	SIG .441	SIG .201			
FLOW	-.0042	.3434	-.598		
	SIG .491	SIG .029	SIG .375		
POE	.0987	-.1144	.2362	-.2728	
	SIG .299	SIG .270	SIG .100	SIG .069	
MODE	.0000	-.2389	-.0355	.2881	-.0530
	SIG .500	SIG .098	SIG .425	SIG .058	SIG .389
FLAG	.1311	.3711	-.4094	.0043	.0598
	SIG .241	SIG .018	SIG .011	SIG .491	SIG .375
SAB	.4734	-.5481	.0350	.1069	.0380
	SIG .004	SIG .001	SIG .426	SIG .284	SIG .420
STO	.2072	-.1723	-.0117	-.3220	.4110
	SIG .132	SIG .177	SIG .475	SIG .039	SIG .011
EMP	-.1094	.1414	.3679	.1879	-.0571
	SIG .279	SIG .224	SIG .021	SIG .156	SIG .380
INSP	-.0844	-.1559	.2491	.0892	-.1321
	SIG .219	SIG .201	SIG .088	SIG .317	SIG .239
SECS	.1448	.1559	.0058	-.2868	-.2579
	SIG .219	SIG .201	SIG .488	SIG .059	SIG .125
YIB	-.0697	-.1144	-.1338	-.1385	-.1923
	SIG .355	SIG .270	SIG .236	SIG .229	SIG .150
YWC	-.1247	-.2948	.0727	-.0706	-.1115
	SIG .252	SIG .054	SIG .349	SIG .353	SIG .275
NOC	.2005	.2764	-.2225	.2212	-.2555
	SIG .140	SIG .066	SIG .114	SIG .116	SIG .390
	DATAX	MILCIV	NOTIFY	FLOW	POE

TABLE 17 (CONTINUED)

SPEARMAN CORRELATIONS

FLAG	-.0964 SIG .303				
SAB	-.0190 SIG .460	-.1688 SIG .182			
STO	-.0908 SIG .314	-.0169 SIG .464	.3598 SIG .023		
EMP	-.1930 SIG .149	-.3852 SIG .016	.0986 SIG .299	.1414 SIG .224	
INSP	-.0071 SIG .485	-.2579 SIG .081	-.0124 SIG .474	-.1559 SIG .201	.1995 SIG .141
SECS	-.2128 SIG .125	.0629 SIG .368	-.1801 SIG .166	-.2308 SIG .106	.1260 SIG .250
YIB	-.0530 SIG .389	.0598 SIG .375	-.0928 SIG .310	-.2458 SIG .091	-.0571 SIG .380
YWC	-.0524 SIG .390	-.1765 SIG .171	.1927 SIG .150	-.0092 SIG .480	.5118 SIG .002
NOC	-.0524 SIG .390	.2555 SIG .083	-.0917 SIG .312	-.1520 SIG .207	.0310 SIG .434
GB	.2586 SIG .080	-.0172 SIG .463	.1019 SIG .293	-.3070 SIG .046	-.1531 SIG .205
	MODE	FLAG	SAB	STO	EMP

TABLE 17 (CONTINUED)

SPEARMAN CORRELATIONS

SECS	.1481				
	SIG .213				
YIB	.0629	-.0629			
	SIG .368	SIG .368			
YWC	.1778	.0342	.3206		
	SIG .169	SIG .428	SIG .039		
NOC	.3898	.2462	.4646	.0606	
	SIG .015	SIG .091	SIG .004	SIG .373	
GB	.1688	-.1688	.0712	.0873	-.2992
	SIG .182	SIG .182	SIG .463	SIG .320	SIG .051
	INSP	SECS	YIB	YWC	NOC

NOTE: This is an SPSSx Spearman Correlation program.

analysis and the impracticality of using so many variables in a discriminant analysis, an attempt was made to find common groupings for the 15 variables and do further testing on the new groups. As a first step to identify these uncorrelated groups, a principal components factor analysis was performed.

Principal Component Factor Analysis: The use of principal component analysis was determined to be a practical approach in attempting to classify many variables into meaningful groups. As one researcher indicates it "Principal components analysis is performed in order to simplify the description of a set of interrelated variables."¹ Using this analysis will produce a new set of variables which are uncorrelated² thereby negating the side effects of multicollinearity. This technique is especially helpful in exploratory research where a better understanding of the interrelationships among the variables is needed.

A principal components factor analysis was performed using the SPSSx program with all 15 variables from the original data. Using the most common type of rotation, Varimax rotation, the analysis produced seven factors which accounted for over 77 percent of the variance of the model. An analysis of the seven factors showed that five of the factors formed "natural" groups of related functions.

Factor one included the variables storage (STO), employees (EMP), inspection (INSP), and secure storage (SECS). These were formed into a new group called "operations" (OPS).

Factor two included the variables military vs. civilian (MILCIV) and amount of total security assistance business (SAB). These formed the new group called business (BUS).

Factor three included the variables of data transmission (DATA) and notification procedures (NOTIFY). They both deal with communicating to the country and formed a new group called TALK.

Factor four dealt with the amount of time a company was in the security assistance business and included the variables years in the business (YIB), years with the country (YWC) and the number of countries with which they did business (NOC). These three variables formed a new group called YEARS.

Factor five dealt with those variables dealing with the transportation functions which included flow time (FLOW), number of ports of entry (POE), shipment mode (MODE), and use of foreign or domestic flag carriers (FLAG). These variables were combined into the new group called TRANS.

Factor six showed a communality between the operations functions previously identified but the relationship was less significant. Factor seven showed a relationship between the transportation functions as listed above, but this was also a weaker relationship than factor five. The

last two factors were not used since they did not add any new relationships not already identified.

All fifteen original variables were plotted on a two dimensional graph. Factor loadings and group classification are found in Table 18. Formation of the new groups is shown in Table 19. The natural groupings can be seen in Figure 6.

Besides the factor analysis grouping of variables into the principal component groups, it makes intuitive sense, based upon the similarity of functions, to group those variables into the categories mentioned above. The factors in variable OPS include those functions which deal with the physical handling of material in the warehouse functions of the freight forwarder. The amount of storage space provided (STO), the number of employees (EMP), the amount of inspection done on arriving material (INSP) and the amount of secure storage provided material (SECS) all deal with warehousing type functions. Similarly, the new variable TALK includes those activities related to transmission of data and communications between the freight forwarder and the country or supplier. The group BUS includes two variables which deal with the type of business activities for each freight forwarder. These include whether the forwarder deals only with military or a combination of military and civilian business. Also, this group includes

TABLE 18

FACTOR LOADINGS AND NEW GROUPINGS
(Using VARIMAX Rotated Factor Matrix)

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
DATAX	-.14586	.06327	.86589	-.07985	.08911	.08504	-.15790
MILCIV	-.01753	.87552	-.32013	-.15308	-.02297	-.10298	.08733
NOTIFY	.54684	-.09612	-.01021	-.24326	.29263	.49017	.17517
FLOW	.19729	.54124	.17955	-.12100	-.53355	.20723	-.48612
POE	-.05737	-.01164	.09402	-.14919	.83580	.17929	-.18358
MODE	-.19718	-.21790	.06098	-.12847	-.41559	.30674	-.41890
FLAG	-.60166	.51243	.04951	.19631	.19536	-.10391	.00950
SAB	.16108	-.32488	.81240	.01307	.00763	-.10341	-.22327
STO	.12506	-.15391	.31383	-.14421	.52806	-.52997	-.19152
EMP	.91556	.15342	-.00665	.02883	.02216	-.14480	.01313
INSP	.38321	.00636	.10509	.27188	-.18118	.43135	.29634
SECS	.02289	.05368	.01057	-.03238	-.17199	-.03430	.87995
YIB	-.09816	-.06895	-.14214	.87336	-.04507	.05327	-.01621
YWC	.53390	-.26062	.00409	.56179	.00317	-.02986	-.09335
NOC	-.01886	.50340	.22807	.60859	-.26038	-.06207	.26538
GB	-.07001	-.09740	.03131	-.00595	.09971	.83243	-.25009

<u>NEW GROUP</u>	<u>FACTOR</u>	<u>ORIGINAL VARIABLES</u>
OPS	1	STO EMP INSP SECS
BUS	2	MILCIV SAB
TALK	3	DATAX NOTIFY
YEARS	4	YIB YWC NOC
TRANS	5	FLOW POE MODE FLAG

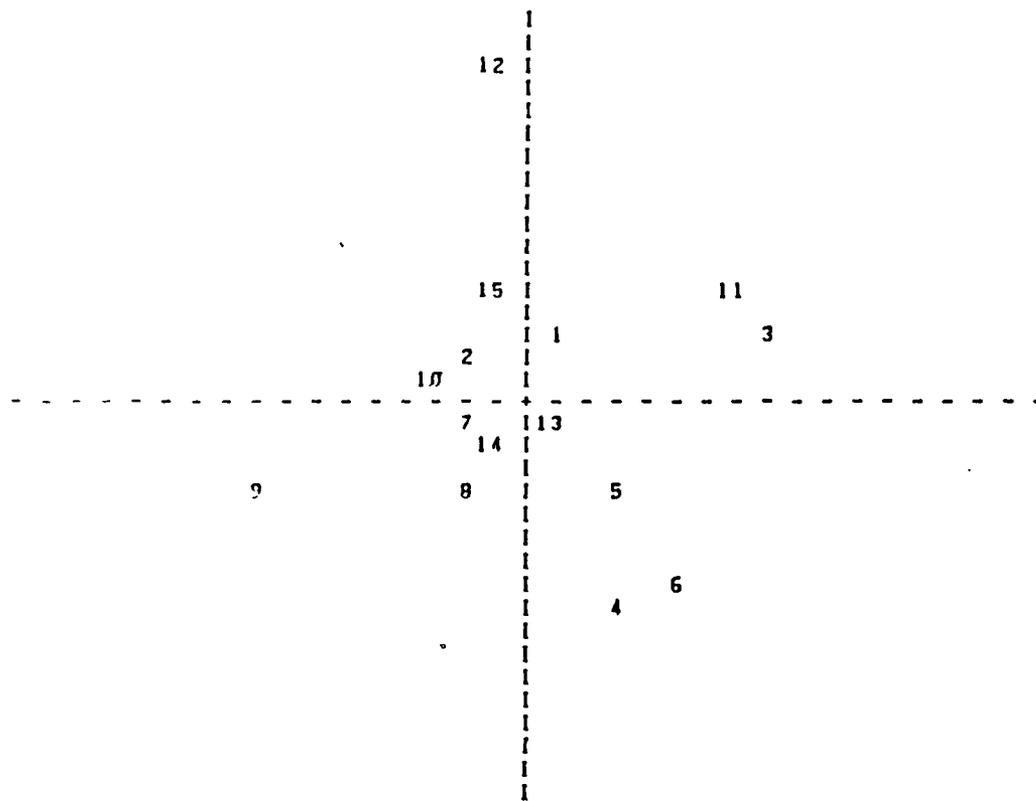
NOTE: This was a Principal Component Factor Analysis program run on the Statistical Package for the Social Sciences.

TABLE 19
CLASSIFICATION OF DATA

NEW NUMBER VARIABLE GROUP	ORIGINAL VARIABLE	GROUP MEMBERSHIP	CRITERIA FOR CLASSIFICATION	IN	
TRANS	FLOW	1	<5 DAYS	19	
		2	>5 DAYS	12	
	POE	1	ONE	18	
		2	MORE THAN ONE	13	
	MODE	1	<25% BY AIR	23	
		2	>25% BY AIR	8	
	FLAG	1	<25% BY FOREIGN	13	
		2	>25% BY FOREIGN	18	
OPS	STO	1	<5000	17	
		2	>5000	14	
	EMP	1	<25	28	
		2	>25	3	
	INSP	1	<5%	27	
		2	>5%	4	
	SECS	1	NO	4	
		2	YES	27	
	TALK	DATAX	1	MAIL	18
			2	TELEX	2
			3	DATAPHONE	0
			4	REG PHONE	1
5			NOT INFORM	4	
6			MAIL PLUS	6	
NOTIFY		1	BEFORE	12	
		2	AFTER	13	
		3	BOTH	5	

TABLE 19 (CONTINUED)

NEW NUMBER VARIABLE GROUP	ORIGINAL VARIABLE	GROUP MEMBERSHIP	CRITERIA FOR CLASSIFICATION	IN
BUS	MILCIV	1	MIL ONLY	17
		2	MIL AND CIV	14
	SAB	1	<25%	15
		2	>25%	16
YEARS	YIB	1	<32	13
		2	>32	18
	YWC	1	<9	22
		2	>9	9
	NOC	1	ONE	22
		2	MORE THAN 1	9



SYMBOL	VARIABLE	COORDINATES	SYMBOL	VARIABLE	COORDINATES
1	DATAK	(.00504, .15790)	2	MILCIV	(-.10298, .08733)
3	HOLLEY	(.49017, .17517)	4	FLOW	(.20723, -.48612)
5	POP	(.17929, -.10350)	6	MODE	(.30674, -.41890)
7	FLAG	(-.10391, .00950)	8	SAB	(-.10341, -.22327)
9	SIO	(-.52997, -.19152)	10	EMP	(-.14480, .01313)
11	UNSP	(.43135, .29634)	12	SECS	(-.03430, .07995)
13	YIB	(.05327, -.01621)	14	YWC	(-.02906, -.09335)
15	ROC	(-.06207, .26530)	16	GB	(.03243, -.25009)

FIGURE 6

FACTOR PLOT-ORIGINAL VARIABLES

the variable SAB which indicates how much of the total business is attributed to security assistance. Both these variables are "type of business" indicators and are included in the same new group.

The new group YEARS includes three variables which are related by how long a forwarder has been in operation. The variable years in business (YIB) indicates total years of experience as a freight forwarder. The variable years with the country (YWC) gives a value for the length of time a forwarder has been serving the same country. A related area is the number of countries served by a freight forwarder (NOC) which could be affected by the length of time a forwarder has been in business.

The variable TRANS deals with those purely transportation-type variables from the original list of variables. These include the flowtime through the forwarder facility (FLOW), the number of ports of entry serviced (POE), the mode of shipment, either surface or air (MODE), and the type of carrier used, either domestic or foreign flag carrier (FLAG).

With the new groups now established by a logical ordering and supported by the results of the original principal components factor analysis, further testing could be done. The first was to perform an Analysis of Variance on the new groups.

Analysis of Variance: Based on the results of the previous tests, it was determined that an analysis of variance test may now prove some significance among the variables. The new variables were processed through the ANOVA program on SPSSx. The five new variables were run on a one-way analysis of variance using the good and bad classification of each case (forwarder). The results showed that TRANS was the only variable with a significance level less than .10. Again, OPS rated second with a significance level of .154. This indicates that the variable TRANS accounts for the most variance in the differences between freight forwarders and that variance is significant at the .09 level. Results of the ANOVA testing are shown in Table 20. These results indicate that there are statistically significant differences between freight forwarders based on the functional grouping of the original variables. The most significant variable was the group TRANS. Results of the ANOVA on the new variables is shown in Table 20.

Analysis of Variance is useful to determine if there are relationships between or within groups of variables. In order to determine if a group, or variable, could classify freight forwarders and whether that group or variable could be used to predict forwarder performance, a different analysis technique was used. The test used for this purpose was a discriminant analysis of the new variable groupings.

TABLE 20

ANALYSIS OF VARIANCE-NEW VARIABLES

<u>OPS BY GB</u>					
<u>SOURCE OF VARIATION</u>	<u>SUM OF SQUARES</u>	<u>DF</u>	<u>MEAN SQUARE</u>	<u>F</u>	<u>SIG OF F</u>
MAIN EFFECTS	1.216	1	1.216	2.142	0.154
GB	1.216	1	1.216	2.142	0.154
EXPLAINED	1.216	1	1.216	2.142	0.154
RESIDUAL	16.462	29	0.568		
TOTAL	17.6771	30	0.589		

<u>TALK BY GB</u>					
<u>SOURCE OF VARIATION</u>	<u>SUM OF SQUARES</u>	<u>DF</u>	<u>MEAN SQUARE</u>	<u>F</u>	<u>SIG OF F</u>
MAIN EFFECTS	2.531	1	2.531	0.456	0.505
GB	2.531	1	2.531	0.456	0.505
EXPLAINED	2.531	1	2.531	0.456	0.505
RESIDUAL	161.146	29	5.557		
TOTAL	163.677	30	5.456		

<u>TRANS BY GB</u>					
<u>SOURCE OF VARIATION</u>	<u>SUM OF SQUARES</u>	<u>DF</u>	<u>MEAN SQUARE</u>	<u>F</u>	<u>SIG OF F</u>
MAIN EFFECTS	2.481	1	2.481	2.923	0.098
GB	2.481	1	2.481	2.923	0.098
EXPLAINED	2.481	1	2.481	2.923	0.098
RESIDUAL	24.615	29	0.849		
TOTAL	27.097	30	0.903		

<u>BUS BY GB</u>					
<u>SOURCE OF VARIATION</u>	<u>SUM OF SQUARES</u>	<u>DF</u>	<u>MEAN SQUARE</u>	<u>F</u>	<u>SIG OF F</u>
MAIN EFFECTS	0.006	1	0.006	0.026	0.873
GB	0.006	1	0.006	0.026	0.873
EXPLAINED	0.006	1	0.006	0.026	0.873
RESIDUAL	6.962	29	0.240		
TOTAL	6.968	30	0.232		

<u>YEARS BY GB</u>					
<u>SOURCE OF VARIATION</u>	<u>SUM OF SQUARES</u>	<u>DF</u>	<u>MEAN SQUARE</u>	<u>F</u>	<u>SIG OF F</u>
MAIN EFFECTS	0.238	1	0.238	0.218	0.644
GB	0.238	1	0.238	0.218	0.644
EXPLAINED	0.238	1	0.238	0.218	0.644
RESIDUAL	31.762	29	1.095		
TOTAL	32.000	30	1.06		

NOTE: This is an SPSSx program for ANOVA.

Discriminant Analysis-New Groups: Discriminant analysis was used to determine if the newly formed variables could be used to classify forwarder into two distinct groups based on performance. This technique is used to "...classify individuals into one of two or more alternative groups (or populations) on the basis of a set of measurements."³ Additionally, discriminant analysis can be used for both description and prediction.⁴ The five new groups were run through the SPSSx Discriminant Analysis package to determine if any group could be used as a discriminator of "good" and "bad" freight forwarders. The results showed that the variable TRANS was significant at the .09 level and that it could correctly classify groups as good or bad 64.52 percent of the time. It was also observed that the variable OPS, while significant at the .15 level, could also predict group membership 64.52 percent of the time. None of the other variables was significant enough to allow the SPSSx package to determine its classification ability. The results of this analysis show that the best discriminator among all groups is the variable TRANS. Although TRANS achieved the highest significance level, OPS was also a reasonable discriminator of good or bad freight forwarders for this sample. Also, even though the percentage of groups correctly classified was the same for both TRANS and OPS, the actual forwarders classified incorrectly differed

between TRANS and OPS. Figure 7 shows the classification of forwarders into groups.

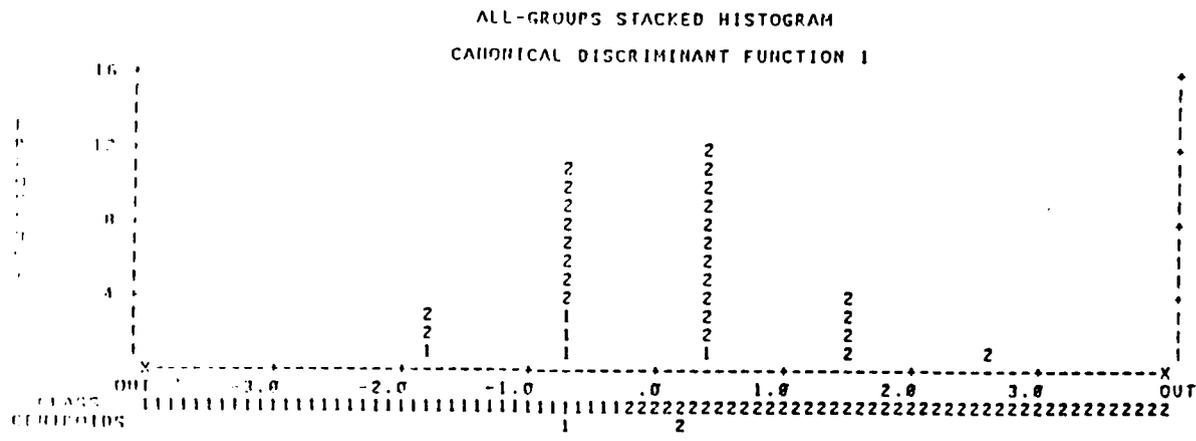
One of the major uses of discriminant analysis is to use the classification results to predict group membership based on the discriminating variable. The classification can be accomplished using Fisher's Discriminant Function⁵ which is obtained from the output of the SPSSx program. Simply stated, Fisher devised a way to represent a bivariate classification using a linear combination of variables and a constant. The area used as a dividing line between the two groups can be defined by the equation $Z = C$, where Z is a linear combination of X_1 and X_2 and C is a constant defined as:

$$C = \frac{Z_1 + Z_2}{2}$$

where Z_1 is the average value of Z in population 1 and Z_2 is the average value of Z for population 2.

The equation can be rewritten into $Z = a_1X_1 + a_2X_2$ for a two variable case.⁶

In this case, the Fisher Discriminant Function can be computed directly from the SPSSx output. By convention⁷ the value of the first term coefficient is obtained by subtracting group 1 value from that of group 2. Table 21 provides the values of the TRANS coefficient and the constant term. For the coefficient of TRANS the value is $5.890625 - 6.796875$ which equals $-.90625$. The constant term



CLASSIFICATION RESULTS -

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP	
		1	2
GROUP 1	5	4 80.0%	1 20.0%
GROUP 2	26	10 38.5%	16 61.5%

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 64.52%

FIGURE 7
FORWARDER GROUP CLASSIFICATION PLOT

CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS (GROUP CENTROIDS)

GROUP	FUNC	1
1	-0.70027	
2	0.13467	
107 SEP 86	adata	
13:13:57	Air Force Inst of Technology	VAX 11/785
		UNIX 4.2 BSD

CASE SEQNUM	HIS VAL	SEL	ACTUAL GROUP	HIGHEST PROBABILITY GROUP	P(D/G)	P(G/D)	2ND HIGHEST GROUP	P(G/D)	DISCRIMINANT SCORES...
1			1	1	1.0000	0.5863	2	0.4137	-0.7003
2			1	2	0.8022	0.6359	1	0.3641	0.3851
3			2	2	0.1816	0.8121	1	0.1879	1.4706
4			2	2	0.1816	0.8121	1	0.1879	1.4706
5			2	1	0.2777	0.7781	2	0.2219	-1.7857
6			1	1	0.2777	0.7781	2	0.2219	-1.7857
7			2	1	1.0000	0.5863	2	0.4137	-0.7003
8			2	1	1.0000	0.5863	2	0.4137	-0.7003
9			2	1	1.0000	0.5863	2	0.4137	-0.7003
10			2	2	0.0155	0.9145	1	0.0855	2.5560
11			2	2	0.8022	0.6359	1	0.3641	0.3851
12			2	2	0.8022	0.6359	1	0.3641	0.3851
13			2	2	0.8022	0.6359	1	0.3641	0.3851
14			2	1	0.2777	0.7781	2	0.2219	-1.7857
15			2	1	1.0000	0.5863	2	0.4137	-0.7003
16			2	1	1.0000	0.5863	2	0.4137	-0.7003
17			2	2	0.8022	0.6359	1	0.3641	0.3851
18			2	2	0.8022	0.6359	1	0.3641	0.3851
19			2	2	0.1816	0.8121	1	0.1879	1.4706
20			2	2	0.1816	0.8121	1	0.1879	1.4706
21			2	2	0.8022	0.6359	1	0.3641	0.3851
22			2	1	1.0000	0.5863	2	0.4137	-0.7003
23			1	1	1.0000	0.5863	2	0.4137	-0.7003
24			2	2	0.8022	0.6359	1	0.3641	0.3851
25			2	1	1.0000	0.5863	2	0.4137	-0.7003
26			1	1	1.0000	0.5863	2	0.4137	-0.7003
27			2	1	1.0000	0.5863	2	0.4137	-0.7003
28			2	2	0.8022	0.6359	1	0.3641	0.3851
29			2	2	0.8022	0.6359	1	0.3641	0.3851
30			2	2	0.8022	0.6359	1	0.3641	0.3851
31			2	2	0.8022	0.6359	1	0.3641	0.3851

NOTE: Data taken from SPSSx program DISCRIMINANT found in Appendix L.

FIGURE 7 (Continued)

FORWARDER GROUP CLASSIFICATION PLOT

is calculated by subtracting the first group from the value of the second group. In this case, the values are:
 $-20.29952 - (-15.41971) = 4.87981$ Combining these into the Fisher's Discriminant Function gives:

$$z = 4.87981 - .90625 X_1 \text{ where } X_1 \text{ is the TRANS factor}$$

The interpretation of this function can be seen by the sign of the coefficient of the TRANS or X_1 variable. A negative sign for the coefficient of "X" means that forwarders with the larger values for TRANS tend to belong to group 1, the "bad" forwarder group.⁸ It is possible to predict group membership by using the value obtained from the X_1 , or TRANS variable.

The data in Table 19 show the categorical classification of the variables used in the discriminant analysis. Using this information, one may be able to predict a "good" or "bad" freight forwarder based on the type of functions or operations now being performed. For example, a freight forwarder who was classified as a "1" in each of the four TRANS categories would receive a score of $4.87981 - .90625(4)$ or 1.25481.

TABLE 21
FISHER'S DISCRIMINANT FUNCTION

POOLED WITHIN-GROUPS CORRELATION MATRIX

	OPS	TRANS	YEARS	BUS	TALK
OPS	1.00000				
TRANS	-0.25985	1.00000			
YEARS	0.10765	-0.11555	1.00000		
BUS	0.13653	0.21155	-0.06984	1.00000	
TALK	0.19565	0.07084	-0.05903	0.34565	1.00000

VARIABLE	WILKS' LAMBDA	F	SIGNIFICANCE
OPS	0.93122	2.142	0.1541
TRANS	0.90842	2.923	0.0980
YEARS	0.99255	0.217	0.6443
BUS	0.99911	0.258e-01	0.8734
TALK	0.98454	0.4555	0.5051

CLASSIFICATION FUNCTION COEFFICIENTS
(FISHER'S LINEAR DISCRIMINANT FUNCTIONS)

GOOD/BAD	=	1	2
TRANS		5.890625	6.796875
(CONSTANT)		-15.419710	-20.299520

Fisher's Discriminant Function gives:

$Z = 4.87981 - .90625 X1$ where $X1$ is the TRANS factor.

NOTE: This is an SPSSx DISCRIMINANT ANALYSIS program.

Below are the combinations of values for the TRANS variable which will result in being classified as either "good" or "bad".

TRANS SCORE	VALUE	GOOD/BAD
4	1.25481	GOOD
5	.034856	BAD
6	-.55769	BAD
7	-1.46394	BAD
8	-2.37019	BAD

The Fisher Discriminant Function will error on the side of the "good" forwarder based on this equation. As is shown in the SPSSx printout, a full 80 percent of the "bad" forwarders were classified correctly while only 61 percent of the "good" forwarders were correctly classified by this formula. The closer one gets to the minimum value (4) for the TRANS variable, the better are the chances to correctly classify the forwarder. As can be seen here, a "perfect" forwarder, getting a low score of only 4, is only marginally "good". This means that if a forwarder varies only one of the TRANS sub-variables by one category, it will be classified as "bad".

The discriminant function, as shown in Table 21, correctly identified twenty of the thirty-one freight forwarders as "good" or "bad" performers. This equates to an overall probability of being able to correctly classify

forwarders 64.52 percent of the time. However, since this research is more interested in identifying "bad" performing freight forwarders, the probability of identifying a "bad" forwarder is of more interest. The algorithm correctly identified 4 of the 5 "bad" freight forwarders. This gives a Type 1 error of .20. Stated differently, the probability of classifying a forwarder as "good" when in fact it was a "bad" forwarder is 20 percent. Conversely, the probability of predicting a forwarder as "bad" when that forwarder is "bad" is 80 percent. The ability of the algorithm to correctly classify "good" forwarders was not nearly as accurate. Of the 26 "good" freight forwarders, only 16 were classified as such. Ten were classified as "bad" when in fact they should have been classified as "good". The Type 1 error for the "good" forwarders was 38.5 percent. The algorithm, therefore, tends to limit the variation allowed for the "good" forwarders. If a mistake was made in classification, it would tend to classify a "good" forwarder as "bad".

Figure 7 lists the forwarders and indicates which forwarders were incorrectly classified. While the overall classification rate was almost 65 percent, the ability of the algorithm to correctly identify and classify "bad" freight forwarders represents a fairly accurate tool to predict performance of freight forwarders using the decision criteria set forth in this research.

Summary

Chapter IV has shown the results of the original proposed research. Additionally, since the data collected was both small in quantity and highly correlated among the various predefined variables, other testing was necessary. The results of that testing showed that by combining variables, either by logic or using validated Principal Component Factor Analysis, it is possible to determine which factors or variables contribute to differences between freight forwarders. Further, it is possible by using Discriminant Analysis of the data to formulate a predictive model which may be used to classify existing forwarders into two distinct groups. Although Fisher's Discriminant Function was able to classify only slightly better than 65 percent of the forwarders into the correct group, this is an initial step which can be further refined to better predict the success or failure of freight forwarder operations.

Chapter V will provide the conclusions to this research and highlight areas where further research in this area may prove beneficial to the international logistician.

ENDNOTES

1. Afifi, A. A. and Virginia Clark, Computer Aided Multivariate Analysis. Lifetime Learning Publications. (Belmont, CA.1986) p.309.
2. Ibid.
3. Ibid. p. 247.
4. Ibid
5. Ibid. p. 253.
6. Ibid
7. Ibid p. 261.
8. Ibid p. 257.

CHAPTER V
SUMMARY AND CONCLUSIONS

Introduction

Chapter V summarizes the research and presents conclusions and implications of the study. The chapter is divided into four sections. The first section reviews the objectives of the research and the research methodology. The second section briefly reviews the hypotheses and findings and presents conclusions based upon the findings. The third section presents theoretical and practical implications. The last section provides suggestions for further research in the area of freight forwarding.

Research Summary

The objective of this research was to identify those services or combination of services performed by freight forwarders which produce the most effective channel of distribution. For purposes of this study, the standard United States Air Force definition of effectiveness was used: the amount of material lost in shipment as part of the total amount of material shipped through a particular distribution channel.¹ The particular channel examined in this research was unique.

The data used came from the freight forwarders who handle shipments from the United States Air Force to one or more foreign governments. These forwarders are commercially chartered United States companies who are contractually bound to the foreign government and are not part of the United States military. As such, no standardization of services was known to exist. However, since all forwarders operate in a similar environment, this research was an attempt to identify which of those services tended to produce better results, defined as fewer material losses in the total system.

To determine which factors or services produced the most effective channel of distribution, four specific areas were set as objectives for this research. For each objective, a dependent and several independent variables were tested. The specific research objectives were:

1. To establish the relationships between the types of information flows, data transmission and the amount of material lost in the specific distribution channel.
2. To establish the relationship among specific transportation functions provided by freight forwarders and the amount of material lost in the distribution channel.
3. To determine if a relationship exists between the origin, routing or destination of requisitions and the amount of material lost in a channel of distribution.

4. To determine the relationship between traffic volume (as measured by the number of shipments and dollar value) to customers and the amount of material lost in the distribution channel.

To examine these relationships several variables were identified. An iterative process, using experts from the Air Force in the field of Security Assistance (the program using the channels studied in this research), was employed to identify and select the appropriate variables used to test the relationships listed above. Once the variables were identified, three sources provided of data to test hypotheses related to each of the relationships. Two data sources were obtained from the United States Air Force International Logistics Center (ILC) and provided information on shipment volume and freight forwarder identification. Firm specific information was then obtained from a questionnaire sent to the population (107) of freight forwarders identified by the ILC.

To examine the first relationship, the independent variable was the "effectiveness index" which was the amount of material lost divided by the total amount of material shipped through the channel. The independent variable tested for the first objective was the form of data transmission used by the forwarder. The forms used by all forwarders were either regular mail service, TELEX service,

Dataphone, or some combination of the three. A second variable was used to test the notification process. Three types of notification processes were tested: notification to the forwarder by the country; notification of the forwarder by the producer (USAF) and the country, in turn; and, notification of the by the producer only.

The second relationships of the second objective used the same independent variable (the "effectiveness index") and was measured by four independent variables. These were: the mode of shipment used; the amount of storage space available; the number of employees; the amount of inspection done on material received at the facility; and the availability of secure storage.

To determine if a relationship exists between the origin, routing or destination of requisitions and material lost in the channel, the third objective, the dependent variable was again the "effectiveness index". Four independent variables were used. These were: the flow time through the forwarder; the number of ports of entry used in the channel; the mode of shipment used; and the type of carrier used.

Research objective four, dealing with volume of business in the channel, used the same independent variable as the other objectives and was tested using five independent variables to determine if a relationship existed. These were: the amount of military versus

commercial business done by the forwarder; the amount of Security Assistance business; the amount of experience of the forwarder; the number of years the forwarder had been in business; and the number of countries serviced by the forwarder. Additionally, a correlation analysis was performed to determine if a relationship existed between the amount of material shipped, losses in shipment, and dollar value of those shipments and losses.

Two other characteristics, believed to be related to the forwarder/country relationship, were used in the overall analyses. The presence of a foreign national representative at the International Logistics Center and the economic development of the country were variables used to examine differences in the amount of material lost in the distribution channel.

The information from the three data sources was combined into a data set and analyzed using the Statistical Package for the Social Sciences (SPSSx). The primary statistical test used for the preliminary part of the research was Analysis of Variance (ANOVA). As the conclusion section of this chapter shows, additional testing was accomplished. Principal Component Factor Analysis and Discriminant Analysis were used after the initial testing. The results of those tests will be addressed in the conclusions section.

Conclusions

The conclusions from this research are presented in two sections. The first section will present the conclusions from testing the original hypotheses. The second section will give the results of the additional testing done after the original tests were performed. Both sections will relate the findings to the research objectives stated in Chapter I.

Results of Hypotheses Testing-Original Variables: The original hypotheses noted in Chapter I represent an estimation of prudent hypotheses based on initial perceptions of forwarder operations and the review by the panel of experts discussed earlier. However, because of the small response rate (only 31 forwarders responded to the questionnaire), not all of the original hypotheses could be tested using ANOVA procedures since all cells must have at least one response. To overcome this, additional hypotheses were constructed combining the known data into groups so that meaningful analyses could be performed. The original theses are listed below. Both the original hypotheses and those hypotheses formed after initial return of the questionnaire are omitted from this chapter but can be found in Chapter IV.

Research Objective 1: To establish a relationship between the types of information flows, data transmission and the amount of material lost in the specific distribution channel.

Thesis 1: The type of data transmission affects material loss.

To test this thesis, five hypotheses testing the three major means of data transmission were tested. These were: mail, TELEX, Dataphone. Also tested were the groups: mail against all other means; and, mail only against mail and all other means of data transmission.

Findings: Using ANOVA procedures, it was found that there are no significant differences between forwarders any of the various data transmission types, or combinations of data transmission types.

Conclusions: None of the null hypotheses could be rejected using ANOVA with this data and therefore the objective of establishing a relationship based on the type of data transmission used by the country and the freight forwarder could not be supported. Therefore, the thesis that the type of data transmission affects material loss must also be rejected.

Thesis 2: The type of data information flow affects material loss.

The data allowed hypothesis testing only whether there were differences between forwarders who notified customers prior

to shipment and those who notified the customers after shipment was made.

Findings: ANOVA procedures failed to find significant results among forwarders who received notification of shipment before, after or both before and after shipment took place.

Conclusions: Analysis of Variance failed to identify any significant differences between the notification procedures used to inform freight forwarders and customers of a shipment. Three groups were tested: group one were notified in advance of shipment; group two were informed after actual shipment of the goods; group three were informed of shipment both before and after the shipment took place. Since none of the groups showed a significant difference, the null hypothesis must be rejected. This variable also does not support the research objective of establishing a relationship between the type of information flow and the amount of material lost in the distribution channel.

Research Objective 2: To establish the relationship among specific transportation functions provided by freight forwarders and the amount of material lost in the distribution channel.

Thesis 3: The amount of inspection done by the freight forwarder affects material loss.

Findings: ANOVA procedures failed to find significant results among forwarders who inspected less than 5 percent and those forwarders who inspected at least 5 percent of the material upon receipt.

Conclusions: The majority of freight forwarders inspected less than 5 percent of the material when received at their facilities. However, there was no significant difference between those forwarders who inspected as much as 10 percent of the material and those who performed less than 5 percent inspection of received goods. This finding does not support the hypothesis that there are differences between the two groups which could account for effectiveness in the distribution channel and is rejected. Therefore, this factor does not support finding a relationship between the specific transportation function of material inspection and the amount of material lost in the distribution channel.

Thesis 4: The consolidation policy of the freight forwarder affects material loss.

Findings: The questionnaires revealed that all forwarders use containerized shipment consolidation as a standard business practice and all forwarders reported they received shipments from multiple producers. Additionally, all stated that they provided a new consolidated Bill of Lading if the shipment was consolidated. Therefore, since all forwarders were in the same category in this area, no analysis could be performed since ANOVA requires at least two groups for analysis.

Conclusions: No conclusions could be drawn for this transportation variable since no differences were observed in the data and no testing could be accomplished. The null hypothesis may be neither accepted nor rejected based on the sample data. The consolidation policy of the forwarder does not support finding a relationship between that specific

transportation variable and the amount of material lost in the specific distribution channel.

Thesis 8: The facilities provided by the freight forwarder affect material loss.

Three hypotheses were formed to test if forwarder facilities accounted for material loss.

Findings: Analysis of Variance found no significant differences between forwarders who provided more than 5000 square feet of storage space and those who provided less than 5000 square feet.

Findings: No significant differences were found using ANOVA testing between forwarders who provided secure storage space and those who had no such dedicated secure storage.

Findings: There were no significant differences between these two groups when tested using ANOVA. The number of personnel made no difference in the amount of material lost in the distribution channel.

Conclusions: All three null hypotheses must be accepted since no significant differences were found between the tested groups. These three variables, the amount of storage space, the availability of secure storage, and the number of employees in the firm, have no statistically significant impact on the amount of material lost in the specific distribution channel. Consequently, these three factors do not support the research objective of establishing a relationship between specific transportation functions and the amount of material lost in the distribution channel.

Research Objective 3: To determine if a relationship exists between the origin, routing or destination of requisitions and the amount of material lost in a channel of distribution.

Thesis 5: Shipment to more than one Port of Entry (POE) affects material loss.

Findings: Use of ANOVA showed no significant differences between forwarders who shipped to a single port of entry and those forwarders who shipped to multiple ports of entry.

Conclusions: Since there were no significant differences between these two groups, the null hypothesis must be accepted and it must be concluded that there are no significant differences between forwarders who ship to only one POE and those who ship to multiple POE's. The finding does not support the research objective that shipping to one or multiple ports of entry is a specific routing decision which could establish a relationship with the amount of material lost in a specific distribution channel.

Thesis 6: The type of carrier affects the amount of material loss.

Two hypotheses were tested to determine if there was a relationship between carrier types affected material loss. The categories were air versus water carriers, and domestic versus foreign flag carriers.

Findings: Results of ANOVA testing showed no significant differences between forwarders who sent less than or equal to 25 percent of their shipments by air and those who sent more than 25 percent of their shipments by air.

Findings: ANOVA tests showed no significant differences between forwarders who shipped less than or equal to 25 percent of their material by foreign flag carrier and those who used foreign flag carries for more than 25 percent of their shipments.

Conclusions: Both null hypotheses must be accepted since neither produced significant results for differences between the two groups. These two variables can not be used to support the research objective of establishing relationships between routing decisions and the amount of material lost in the distribution channel.

Thesis 11: Flow times through the freight forwarder affects material loss.

Findings: ANOVA testing revealed no significant differences between forwarders who had flow times of 5 or fewer days and those who had more than 5 days as an average time for material to get through the forwarder facility.

Conclusions: Since no significant differences were found, the null hypothesis was accepted. Differences in flow times does not account for differences in material loss in this sample data. The flow time variable can not be used to support the research objective of establishing a relationship between routing differences and the amount of material lost.

Research Objective 4: To determine the relationship between traffic volume to the customers and the amount of material lost in the distribution channel.

Several hypotheses were tested to support this Research Objective 4.

Thesis 7: The volume of traffic to a customer affects material loss.

Findings: The Spearman rank order correlation showed that there is a positive and significant relationship between the shipment value and the amount of material lost in the channel.

Conclusions: Since there was a statistically significant relationship found, the hypothesis that there is no significant difference between material loss and value of shipments through a freight forwarder must be rejected. This finding supports the research objective that there is a positive and statistically significant relationship between the amount of material lost and the dollar value of those shipments. Additionally, review of the data shows that while only approximately one percent of the shipments are actually lost, those shipments account for more than three percent of the total dollar value of all shipments. It can be concluded that items lost tend to be of higher value than the average item shipped.

Findings: The analysis determined that there was a positive and significant (at the .000 level) relationship between material loss and the number of shipments through a freight forwarder.

Conclusions: Since the Spearman rank order correlation was significant, the hypothesis that there is no relationship between shipment volume and material loss must be rejected. The thesis that the volume of shipments affects material loss may be accepted.

Findings: Results of the ANOVA showed no significant differences between forwarders who had at least 25 of their business with the U.S. Air Force and those whose business with the Air Force was less than 25 percent.

Conclusions: The null hypothesis was accepted. The amount of business with the United States Air Force as compared to the total amount of business could not account for differences in the amount of material lost in a distribution channel and can not support research objective number four.

Thesis 10: Performing as an exclusive freight forwarder affects material loss.

Findings: Results of the ANOVA show there is no significant differences between freight forwarders servicing one customer and those forwarders serving more than one customer.

Conclusions: The hypothesis was accepted since no significant differences appeared which could account for material loss. This hypothesis can not support the research objective that routing variables may establish a relationship between shipment volume and the amount of material lost in the distribution channel.

Findings: ANOVA testing showed that there are no significant differences in material loss between freight forwarders handling only shipments to foreign military customers and those forwarders shipping to both military and civilian customers in the foreign country.

Conclusions: The hypothesis was accepted. There are no differences between forwarders who deal exclusively with foreign military customers and those forwarders who service both military and civilian commercial customers. This variable will not support the research objective of determining a relationship between traffic volume and the amount of material loss in the distribution channel. The last two hypotheses were not designed to support any of the four research objectives previously mentioned. They are variables which are beyond the control of the freight forwarder but which could possibly help explain why there are differences in the number of losses reported between countries and freight forwarders. The objective of including these variables is to determine if other factors may account for differences in material loss.

Thesis 9: The presence of a customer representative in the United States affects material loss.

Findings: ANOVA and Spearman correlation analysis found that there was no difference between these two groups.

Conclusions: The hypothesis was accepted. The ANOVA tests showed no significant differences between forwarders whose customers had a representative in the United States and

those forwarders whose country did not have a representative. The Spearman correlation coefficient showed that there was a negative correlation although it was very weak (significant at the .233 level). A negative correlation denotes an inverse relationship exists which indicates that the presence of a representative may aid in the effectiveness of the channel. The Spearman analysis also gave a positive and significant correlation between the presence of a representative and the total number of losses submitted (at the .000 level), the number of total shipments (at the .001 level) and the shipment value (at the .000 level). These three correlations would indicate that since the variables are also strongly correlated and significant, the countries with the larger volume and dollar value programs also are the ones which have, and can afford, an in-country representative. Since the effectiveness measure is formed from total losses divided by total shipments, the positive correlations are to be expected and are due to colinearity among the three variables. The colinearity problem has been noted previously and will be addressed later in the conclusions. Since the ANOVA test is the more powerful of the two and since the correlation between a representative and the number of losses was very weak, it is concluded the presence of a representative does not explain differences in material loss in the distribution channel. Since the hypothesis was accepted, it can be concluded that

the presence of a representative does not affect the amount of material loss and cannot support the existence of a relationship between this variable and the amount of material lost in the distribution channel.

Thesis 12: The economic development of a country affects material loss.

Findings: Neither ANOVA nor the Spearman correlation gave significant findings between countries classified as developing and those countries classified as developed.

Conclusions: The hypothesis is accepted. The two groups were formed using the Organization for Economic Cooperation and Development (OECD) classification criteria. Group one contained 31 forwarders contractually bound to economically developed countries. Group two contained 26 forwarders linked to developing nations. Although not statistically significant, the Spearman correlation was negative. This would indicate that the more advanced, or economically developed countries tend to lose less material. However, due to the weak correlation and the level of significance, the null hypothesis must be accepted and it can be concluded that the economic development of the country does not account for differences in material loss for these forwarders. The hypothesis does not support the objective of finding a relationship between economic development and the amount of material lost in the distribution channel to that country.

TABLE 22
SUMMARY OF SUPPORT FOR RESEARCH OBJECTIVES
FROM HYPOTHESES TESTING

RESEARCH OBJECTIVE ONE:

CATE- GORY	LOSS CAUSED BY	TEST RESULT	CONCLUSIONS
THESIS 1	TYPE OF DATA TRANSMISSION		NOT SUPPORTED
H1.1	Mail vs TELEX	Accept	No Effect
H1.2	TELEX vs Dataphone	N/A	N/A
H1.3	Dataphone vs Mail	N/A	N/A
H1.4A	Mail vs Other	Accept	No Effect
H1.5A	Mail Plus Other	Accept	No Effect
THESIS 2	TYPE OF NOTIFICATION		NOT SUPPORTED
H2.1	Type 1 and Type 2	N/A	N/A
H2.2	Type 2 and Type 3	N/A	N/A
H2.3	Type 1 and Type 3	N/A	N/A
H2.4A	Before or After	Accept	No Effect

RESEARCH OBJECTIVE TWO:

CATE- GORY	LOSS CAUSED BY	TEST RESULT	CONCLUSIONS
THESIS 3	INSPECTION		NOT SUPPORTED
H3.1	Inspection	Accept	No Effect
THESIS 4	CONSOLIDATION		NOT SUPPORTED
H4.1	Consolidation	N/A	N/A
H4.2	Multiple Producers	N/A	N/A
H4.3	Bill of Lading	N/A	N/A
THESIS 8	FORWARDER SERVICES		
H8.1	Full vs. Partial	N/A	N/A
H8.2A	Storage Space	Accept	No Effect
H8.3A	Secure Storage	Accept	No Effect
H8.4A	Employees	Accept	No Effect

TABLE 22, Continued

RESEARCH OBJECTIVE THREE:

CATE- GORY	LOSS CAUSED BY	TEST RESULT	CONCLUSIONS
THEESIS 5	PORTS OF ENTRY		NOT SUPPORTED
H5.1	One vs. Multiple	Accept	No Effect
THEESIS 6	CARRIER TYPE		NOT SUPPORTED
H6.1	Air vs. Water Modes	N/A	N/A
H6.2	Flag Carrier	Accept	No Effect
H6.3A	Majority by Air	Accept	No Effect
H6.4A	More by Foreign Flag	Accept	No Effect
THEESIS 11	FLOW TIMES		
H11.1	Flow Time	Accept	No Effect

RESEARCH OBJECTIVE FOUR:

CATE- GORY	LOSS CAUSED BY	TEST RESULT	CONCLUSIONS
THEESIS 7	VOLUME BY CUSTOMER		SUPPORTED
H7.1	Dollar Value	REJECT	Increases with value
H7.2	Shipment Volume	REJECT	Increases with more
H7.6A	Amount with USAF	Accept	No Effect
THEESIS 10	EXCLUSIVE SERVICES		NOT SUPPORTED
H10.1	Number of Customers	Accept	No Effect
H10.2	Multiple Producers	N/A	N/A
H10.3A	Military/civilian	Accept	No Effect

OTHER THESES:

CATE- GORY	LOSS CAUSED BY	TEST RESULT	CONCLUSIONS
THEESIS 9:	CUSTOMER REPRESENTATIVE		NOT SUPPORTED
H9.1	Customer rep	Accept	No Effect
H12.1	Economic development	Accept	No Effect

In addition to the hypotheses tests described above two other hypotheses were advanced and tested. First was the test to determine if there were differences between two groups based on the number of years they have been in the freight forwarding business.

Findings: Neither ANOVA nor Spearman correlation gave statistically significant results between the two forwarder groups.

Conclusions: The groups were divided by their mean (32.77 years). Since neither test proved significant, the hypothesis must be accepted and it can be concluded that there is no significant difference in the amount of material loss based on the number of years a company is in the forwarding business. It can be concluded that the number of years a company has been in the freight forwarding business does not produce a relationship with the amount of material lost in the distribution channel.

A second hypothesis was used to determine if the number of years a company had been serving the same customer may account for the differences in material loss between forwarders. The null hypothesis for this test was:

Findings: Neither ANOVA nor the Spearman correlation produced statistically significant results.

Conclusions: Since neither test was significant, the hypothesis must be accepted and it can be concluded that there is no significant difference in material loss between

these two groups of freight forwarders which is based upon the amount of time the forwarder has provided service to the country. The hypothesis does not establish a relationship between the length of time the forwarder has provided service for the same customer and the amount of material loss in the distribution channel.

Conclusions From Additional Analyses

Since the data analyses did not show many significant results using Analysis of Variance on the originally defined variables, more analysis, using different techniques were performed. In addition to the small sample size, it was found that many of the variables were correlated to one another.

The use of principal component factor analysis was used to produce a new set of variables which are uncorrelated thereby negating the side effects of multicollinearity. This technique is especially helpful in exploratory research where a better understanding of the interrelationships among the variables is desired.

The analysis produced seven factors of which five formed "natural" groups of related functions. Factor one included variables associated with facility operations and were called OPS. Factor two included variables related to the type of business activity and were called BUS. Factor three was called TALK since these two variables dealt with data transmission and notification procedures. Factor four

comprised variables dealing with the amount of time the forwarder had been in business. These were called YEARS. Factor five was made up of transportation functions and was called TRANS. The last two factors had only weak relationships between any of the variables. Below are the new factors and the variables from which they are made.

OPS- amount of storage space, availability of secure storage, amount of inspection accomplished, number of employees

BUS- amount of military and civilian business, amount of Security Assistance Business

TALK- type of data transmission, type of notification procedure

YEARS- number of years in business, number of years with the same country, number of countries serviced

TRANS- flow time through facility, number of ports of entry serviced, mode of shipment, amount of foreign versus domestic flag carrier used

With the groups produced by principal component factor analysis, further testing was accomplished. As in the original analyses, the purpose was to determine if there were any significant differences among the new variables which could determine a relationship with the amount of material lost in the distribution channel. Two groups were formed for each factor using a "good" or "poor" performance classification based on the each forwarder's measure of effectiveness, identified originally. The hypotheses to be tested were:

Hypothesis 15.1: There are no significant differences between "good" or "poor" freight forwarders caused by the operations (OPS) factors.

Hypothesis 15.2: There are no significant differences between "good" or "poor" freight forwarders caused by the data transmission (TALK) factors.

Hypothesis 15.3: There are no significant differences between "good" or "poor" freight forwarders caused by the business (BUS) factors.

Hypothesis 15.4: There are no significant differences between "good" or "poor" freight forwarders caused by the years of operation (YEARS) factors.

Hypothesis 15.5: There are no significant differences between "good" or "poor" freight forwarders caused by the transportation (TRANS) factors.

Findings: Using ANOVA procedures, only Hypothesis 15.5 was statistically significant. The other hypotheses did not show a statistically significant relationship.

Conclusions: Hypothesis 15.5 was rejected. Hypotheses 15.1, 15.2, 15.3, and 15.4 were accepted. The TRANS factor which included the flow time through the forwarder, the number of ports of entry used, the mode of shipment used, and the amount of foreign flag carrier used, did account for differences between "good" and "poor" performing freight forwarders. It can be concluded that the transportation factors used in this analysis does account for differences in material lost in the channel of distribution. This conclusion supports the objective of the research of finding a relationship between transportation functions and the amount of material lost in a distribution channel.

Conclusions from a Prescriptive Perspective

Analysis of Variance testing was useful to establish that a relationship existed between transportation variables and the amount of material lost in a distribution channel. Of greater value would be the ability to use the results of this research to classify forwarders according to the types of services they provide. In order to determine if a factor, or variable, could classify freight forwarders as "good" performer or "poor" performer, and whether that group or variable could be used to predict forwarder performance, a discriminant analysis technique was used.

The results of the discriminant analysis revealed that the TRANS factor was the best discriminator among the five factors and that it could correctly classify the research group of freight forwarders with a 64.52 percent accuracy level. It correctly classified "good" forwarders into the good group in 61.50 percent of the cases (16 of 31 cases). More importantly, it was able to classify "bad" forwarders correctly 80.00 percent of the time (4 of 5 forwarders). It is concluded that by using the TRANS variable, as defined by this research, forwarders can be correctly identified as being a poor performer 80 percent of the time. Further, it is concluded that if a mistake was made in classifying a freight forwarder, there is almost twice the chance that a "good" forwarder would be classified as "bad" than a "bad" forwarder being classified as "good". Only 20 percent of

the "bad" forwarders were misclassified as "good" while over 38 percent of the "good" forwarders were misclassified as "bad" forwarders.

Using Fisher's Discriminant Function, it is possible to predict group membership using a constant and the value of the discriminating variable for each forwarder. For this research the discriminating function was computed to be:

$$Z = 4.87981 - .90625 X_1$$

where X_1 is the TRANS variable

The interpretation of this function can be seen by the sign of the coefficient of the TRANS or X_1 variable. A negative sign for the coefficient of "X1" means that forwarders with the larger values for the TRANS factor tend to belong to group 1, the "poor" performing forwarder group. It is possible to predict group membership by using the value obtained from the X_1 , or TRANS factor.

Given this formula, it is possible to determine whether the forwarder will be classified as providing "good" or "poor" service. If the sum of the scores for each variable with the TRANS factor is 4, then the forwarder will be classified as "good". Any values summing to over 4 will result in an evaluation as a "poor" performing freight forwarder.

Overall Conclusion

This research has shown that there is a significant relationship between the amount of material lost in an intermodal shipment, except for volume, which can establish a relationship between the amount of material lost in an intermodal shipment and the amount of material lost in an intermodal shipment.

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AN ANALYSIS OF FREIGHT FORWARDER OPERATIONS IN AN
INTERNATIONAL DISTRIBUTION CHANNEL (U) AIR FORCE INST OF
TECH WRIGHT-PATTERSON AFB OH F W WESTFALL 1967
AFIT/CI/NR-87-128D

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1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0

channel. The study looked for simple linear relationships among 15 independent variables in an attempt to identify such a relationship. The conclusion can be made, however, that a combination of transportation variables can account for the amount of material lost in the channel. Using the factor found to be significant, it is possible to evaluate and predict forwarder performance by knowing how certain transportation functions are accomplished. Valuable implications to both the theory of channel performance management and to the practitioner of international distribution channels have resulted from this research.

Implications of This Research

This research offers a number of insights into the operation, understanding and functioning of international freight forwarders. The results of this research will help advance the body of knowledge relative to the conceptual foundations of international distribution channel management as well as provide the practitioner useful management tools.

Contributions to the Conceptual Foundations of Channel Management: As noted in Chapter III, there is but a small body of literature relative to the operations of distribution intermediaries in an international channel. This research has provided empirical data which identifies functions performed by forwarders in a similar international

distribution channel. This research has shown that while all forwarders perform the same basic tasks, their individual performances vary considerably in terms of the amount of material lost in the distribution channel.

This research has contributed to the concept and understanding of performance evaluation in international distribution channel management by determining the relative importance of the distribution facilitating functions performed by freight forwarders. It has proven that no single factor or variable accounts for a statistically significant difference in the performance characteristics of freight forwarders in an international distribution channel. Instead, this research has shown that there are multiple factors or variables which, when combined, can indicate the performance of forwarders with a high probability. That finding would indicate that there are interactions among the variables studied in this research. Prior to this research, no published study had determined which functions could be responsible for differences in the performance of freight forwarders working in a similar environment. Here, the research revealed that transportation functions are better discriminators of performance than are communications links, amount of experience and length of time servicing the same customer, various physical facility factors, and the type of business customer serviced.

Contributions to Practitioners: To the practitioner, this research should be valuable in several ways. Although this research used data from the distribution channel associated with the United States Air Force Security Assistance Program, that channel closely resembles a commercial export business in the civilian sector. Therefore, to the exporter, this study has presented a framework for identifying those factors or functions performed by freight forwarders which cause losses to occur within a channel of distribution. The exporter may use the findings of this research to select or modify those services performed by their present freight forwarder. Depending on the type of channel relationship present in a channel, the exporter or the customer may use the findings of this research as a framework to evaluate the performance of existing channel members and make modifications to the transportation factors found to be significant in this study. If such a channel does not already exist, the results of this research may be helpful in establishing new channels of distribution by selecting those forwarders who provide the services identified in this research as having the potential to be the most important to an effective distribution channel. This implication may aid the international logistician in providing improved customer service through better, more effective channel management. For example, a forwarder or customer may wish to spend extra money on shipping by U.S.

can not afford to purchase forwarder services from the selection of current commercial concerns. The concept has the potential for all countries at a later date. If the U.S. government finances the forwarder operation, the findings of this research can show the Air Force which functions offer the best potential for an effective distribution channel. If the conceptual organization is fully funded, where the country pays all associated expenses, the Air Force can use the results of this research to advise foreign governments as to which functions they should seek from the Air Force forwarder or a commercial forwarder. Such advise becomes most important for poorer countries who may not be able to afford the "extra" services offered by some freight forwarders. Contracting for those services identified in this study before other services should provide customers the most cost effective distribution channel. Additionally, it may be economically desirable for the Air Force to subsidize certain forwarders to ensure they provide effective service to the customer countries. The amount of such a subsidy should be less than the expected gains from having fewer losses in the system.

The main practical implication of this research is the identification of factors which will help reduce losses in the specific distribution channel studied and provide the international logistician a management tool. Reduced losses increase effectiveness and should improve efficiency within

the channel. This study will provide a management tool for Air Force personnel working with international distribution systems such as the Security Assistance Program. Until now no such management tool was available.

Suggestions for Future Research

The economic realities of the 1980's makes it necessary for the United States to be an effective as well as efficient international distributor of goods. This research has provided an initial step by identifying areas which will improve the effectiveness of international distribution channels. However, there are many other areas which provide potential for additional research.

1. Future research should expand upon this research by investigating the possible interactions among the variables identified in this study. It was shown that no relationship could be established between any single factor and the amount of material lost in the distribution channel. It did conclude that a certain combination of variables could account for material loss. Such a finding could indicate that there are multiple interactions among the variables or the presence of non-linear relationships among the variables. Multiple ANOVA techniques using some variables as blocking factors may produce useful results. To be able to use these techniques properly, future research should use a larger data base for analysis. A main limiting factor in this research was the very small sample size, which was

partly a result of starting with a relatively small population. A larger data base would allow much more precision using the same or other data analysis techniques.

2. It is suggested that future studies be done on the civilian commercial export companies using freight forwarders rather than the military system as used in this research. While the similarities among civilian companies will be fewer, there may be areas which were not discovered in this research because of the homogeneous nature of the military freight forwarder/Security Assistance system. However, it should be noted that such a study would likely involve different motives for both the forwarders and their customers. In this research, effectiveness was the overriding concern. In a civilian study, system efficiency will in many cases dictate which functions are performed and how they are accomplished.

3. As a corollary to the research suggested above, it is suggested that research be done with the same forwarders looking at the same factors but using an efficiency measurement rather than the effectiveness measurement used in this research. Analyzing the function and the cost of performing that function would require forwarders to identify costs of providing the services for which they are contractually bound to the foreign government. Such research may show that an entirely different set of factors

may define the relationship between freight forwarders and the amount of material lost in a distribution channel.

4. A final area recommended for future research is to include the receiving end of the international distribution channel in the study. An investigation into the distribution infrastructure of the receiving country may provide valuable insight about why countries select certain functions over others. It may also help explain why losses occur for some forwarders and not others shipping to a country with a similar culture and environment. This research covered only the shipping end of the distribution channel. Including the entire channel would provide a logical extension to this research.

Summary

This chapter presented conclusions based upon the findings of the research. Implications of those findings on both management and theory were discussed. Several suggestions for future research were provided.

ENDNOTE

1. Compendium of Authenticated Systems Terms, Definitions and Acronyms, Department of the Air Force, Air University, (Air Force Institute of Technology, 1981) page 248.

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APPENDICES

APPENDIX A

INTERNATIONAL FREIGHT FORWARDER QUESTIONNAIRE

THE PURPOSE OF THIS QUESTIONNAIRE IS TO OBSERVE THE DIFFERENCES IN FREIGHT FORWARDER OPERATIONS BETWEEN THE VARIOUS COUNTRIES ENGAGED IN SECURITY ASSISTANCE PROGRAMS WITH THE UNITED STATES AIR FORCE.

Please provide the name(s) of the country for which you provide freight forwarder services and the length of time you have done so:

Country (1) _____ FOR _____ YEARS.
(2) _____ FOR _____ YEARS.
(3) _____ FOR _____ YEARS.
(4) _____ FOR _____ YEARS.

PLEASE USE THE FOLLOWING INSTRUCTIONS WHEN FILLING OUT THIS QUESTIONNAIRE:

- A. If you are not familiar with the terms in any question, refer to the last page of this questionnaire for an explanation of the terms as used in this survey.
- B. If you provide services for a single country, simply mark each question with a single check mark to the left of the appropriate response.
Example: Do you understand this procedure?
 A) Yes, it is understood.
 B) No, it is not understood.
- C. If you provide services for more than one country, mark each question with the appropriate country number (from the list in question 3, above) to the left of each response.
Example: If you provide services for 4 countries, mark the questions in this manner:
When do you notify the customer of a shipment from your organization?
 A) In advance of actual shipment.
 B) After shipment has occurred.
 C) Do not notify customer.

If there are any questions about the procedures for marking a response or of the questions themselves, please call:

LIEUTENANT COLONEL FREDERICK W WESTFALL
THE UNITED STATES AIR FORCE INSTITUTE OF TECHNOLOGY
SCHOOL OF SYSTEMS AND LOGISTICS
(513) 255-5023/5098 (Office, Commercial)
785-5023/5098 (Office, Autovon)
(513) 236-4476 (Home)

SECTION I.

1. How are you informed of the notice of availability (NOA) for a shipment?
- 18 A. By mail.
2 B. By TELEX message.
0 C. By Dataphone.
1 D. By regular telephone.
4 E. Usually not informed prior to receipt of shipment at this location.
6 F. Other (please specify) COMBINATIONS OF A, B, D
2. Who provides the notice of availability information to you?
- 22 A. The United States Air Force point of shipment.
3 B. Foreign government personnel.
0 C. The United States Air Force country manager.
3 D. Usually not informed prior to receipt of shipment at this location.
3 Other (please specify) AE-2, ABC-1
3. How do you notify the customer of a shipment from your firm?
- 6 A. By Mail.
11 B. By TELEX message.
1 C. By regular telephone.
1 D. By Dataphone.
1 E. Do not notify customer.
2 F. Other (please specify) AB-4, CF-1
BF-1, BC-1, ABC-2
4. Does your company receive shipments FROM:
- 0 A. United States Air Force sources only.
31 B. Air Force and others (DOD or commercial).
0 C. Other (please specify)
5. Does your company receive shipments FOR:
- 3 A. The foreign air force ONLY.
14 B. The foreign air force and other foreign services ONLY.
14 C. Foreign services AND commercial business.
0 D. Other (please specify)
6. When do you notify the customer of a shipment from your firm?
- 12 A. In advance of actual shipment.
13 B. After shipment has occurred.
1 C. Do not notify customer.
5 D. Other (please specify) AB-5
7. How long do shipments stay within your firm before being forwarded?
- 4 A. More than two working weeks.
8 B. One to two working weeks.
1 C. More than five working days.
17 D. Less than five working days.
0 E. Other (please specify)
8. What are the decision rules for onward shipment?
- 5 A. Shipments are held for consolidation.
5 B. Shipments are held for scheduled transportation.
2 C. Shipments are held for a specific transportation mode.
3 D. Shipments are sent on first available transportation mode.
6 E. Shipments are dictated by customer.
10 F. Other (please specify) AR-3, AB-2
BC-2, ABCD-2, AD-1, BCD-1
9. Does your organization ship TO:
- 18 A. A single Port of Entry.
13 B. Two or more Ports of Entry (please specify the number of shipment ports for each country.)
- | | |
|---------|-----------------|
| Country | Number of Ports |
- SECTION II. In the next set of questions, please mark the exact percentage, if known, in choice (E). If not known exactly, please select the best choice among alternatives (A) through (D).
1. What percentage of your shipments are sent by air?
- 23 A. 0 to 25 per cent.
8 B. 26 to 50 per cent.
0 C. 51 to 75 per cent.
0 D. 76 to 100 per cent.
0 E. Exact percentage is
2. What percentage of your shipments travel by foreign flag carriers?
- 13 A. 0 to 25 per cent.
18 B. 26 to 50 per cent.
0 C. 51 to 75 per cent.
0 D. 76 to 100 per cent.
0 E. Exact percentage is
3. For each country you export to, please identify what percentage of your total business is attributed to Security Assistance (The remainder should be commercial, non Security Assistance business)
- 15 A. 0 to 25 per cent.
15 B. 26 to 50 per cent.
1 C. 51 to 75 per cent.
0 D. 76 to 100 per cent.
0 E. Exact percentage is

4. Please indicate which of the factors listed below influence your company's choice of carrier type (land, sea or air) to foreign Port(s) of Entry.

LEGEND:

1 = extremely important 4 = not very important
2 = very important 5 = extremely unimportant
3 = important

- A. Carrier choice directed by country
12 1 8 2 6 3 3 4 1 5
- B. Priority of the shipment
18 1 5 2 3 3 1 4 0 5
- C. Freight rate charges
4 1 7 2 13 3 2 4 1 5
- D. Frequency of service
9 1 6 2 8 3 2 4 2 5
- E. Reliability of service
16 1 4 2 5 3 1 4 1 5
- F. Foreign ports served by carrier
7 1 11 2 4 3 2 4 3 5
- G. Freight damage or loss record of carrier
11 1 9 2 6 3 0 4 1 5
- H. Carrier reputation
7 1 10 2 9 3 0 4 1 5
- I. Transit time of carrier
6 1 12 2 8 3 0 4 1 5
- J. Special handling requirements
8 1 8 2 8 3 3 4 0 5
- K. Past experience with carrier
7 1 9 2 7 3 2 4 2 5
- L. Other (please specify) CUSTOMER DICTATES
_____ 1 _____ 2 _____ 3 _____ 4 _____ 5

5. Please indicate which of the factors listed below influence your company's choice of carrier type (specific airline, KLM, BOAC, etc., or specific sea carrier) to foreign Port(s) of Entry.

LEGEND:

1 = extremely important 4 = not very important
2 = very important 5 = extremely unimportant
3 = important

- A. Carrier choice directed by country
11 1 6 2 7 3 2 4 2 5
- B. Priority of the shipment
18 1 6 2 2 3 1 4 0 5
- C. Freight rate charges
5 1 11 2 5 3 4 4 2 5
- D. Frequency of service
11 1 8 2 6 3 1 4 1 5
- E. Reliability of service
14 1 5 2 6 3 1 4 1 5
- F. Foreign ports served by carrier
6 1 12 2 9 3 1 4 1 5

- G. Freight damage or loss record of carrier

9 1 7 2 10 3 0 4 1 5

- H. Carrier reputation

8 1 6 2 11 3 1 4 1 5

- I. Transit time of carrier

7 1 12 2 7 3 0 4 1 5

- J. Special handling requirements

4 1 11 2 10 3 2 4 0 5

- K. Past experience with carrier

5 1 11 2 9 3 1 4 1 5

- L. Other (please specify) CUSTOMER DICTATES

_____ 1 _____ 2 _____ 3 _____ 4 _____ 5

SECTION III. From the list below, please identify which services you provide for each country. Again, if you serve more than one country, please specify services for each.

- 21 1. Obtain export licenses.
- 31 2. Provide warehouse and storage space.
- 26 3. Provide additional processing or packaging of material for follow-on shipment.
- 31 4. Make transportation arrangements.
- 28 5. Obtain customs clearances.
- 26 6. Provide financial services (payment for goods or services)
- 26 7. Initiate claims filing paperwork.
- 27 8. Handle return of reparable material in reverse distribution flow
- 15 9. Obtain insurance for material
- 16 10. Provide notice of availability to country
- 11 11. Initiate Reports of Discrepancy (DD Form 364).
- 29 12. Provide tracer action on missing shipments.
- 17 13. Provide for pilot pickup (foreign air force) of material when requested
- 28 14. Consolidate material for follow on shipment.
- 27 15. Provide consolidated bill of lading to country.
- 30 16. Provide containerized shipment service if requested to do so
- 16 17. Inspect material upon receipt at this facility
- _____ 18. Other (please specify) MARK DATA

SECTION IV: FACILITIES

This next set of questions pertains to the physical facilities of your present location. If answers vary according to individual country's programs or requirements, please mark the question by identifying each country, as in previous questions.

- Approximately how many square feet are devoted to your country's Security Assistance material?
 - 7 A. Less than 1,000 square feet.
 - 10 B. Between 1,000 and 5,000 square feet.
 - 3 C. Between 5,000 and 10,000 square feet.
 - 11 D. More than 10,000 square feet.
- How many people are employed at this facility who are working only on Security Assistance programs?
 - 28 A. Less than 25 people.
 - 2 B. Between 25 and 50 people.
 - 1 C. Between 50 and 100 people.
 - 0 D. More than 100 people.
- If you have multiple country programs at this location, do you provide separated storage for each?
 - 22 A. Does not apply. Only one country is represented at this location.
 - 9 B. Yes, separate storage is given to each country's program.
 - 0 C. No, separate storage is not provided to each country's program.
- Is inspection performed on inbound material?
 - 27 A. Does not apply. Contract does not call for inspection services.
 - 2 B. Yes, less than 5 per cent of inbound material is inspected.
 - 2 C. Yes, between 5 and 10 per cent of inbound material is inspected.
- Is climatic controlled storage (temperature and/or humidity) available as necessary?
 - 21 A. Does not apply. Contract does not call for such facility or it is not needed due to nature of material in this program.
 - 10 B. Yes, such storage is provided as necessary.
- Is secure storage available as necessary?
 - 4 A. Does not apply. Contract does not call for such facility or it is not needed due to nature of material in this program.
 - 27 B. Yes, such storage is provided as necessary.

SECTION V. In most cases, Freight Forwarder Services to Security Assistance countries are limited by the terms and conditions of a contract.

From a FREIGHT FORWARDER PERSPECTIVE, please rate the following services according to the value you perceive them to have in providing an efficient Freight Forwarding Service to an international distribution channel. Assume an open-ended contract.

SCALE:
 1 = extremely important 4 = not very important
 2 = very important 5 = extremely unimportant
 3 = important

- Obtain export licenses
1 15 24 30 45 51
- Provide warehouse and storage space.
1 23 25 32 40 50
- Provide additional processing or packing material for follow-on shipment.
1 7 21 37 46 50
- Make transportation arrangements.
1 23 24 33 40 50
- Obtain customs clearances.
1 22 24 32 41 51
- Provide financial services (payment for goods or services).
1 11 26 38 44 51
- Initiate claims filing paperwork.
1 6 29 31 24 25 1
- Handle return of reparable material in reverse distribution flow.
1 10 21 37 42 50
- Obtain insurance for material.
1 4 28 39 43 56
- Provide notice of availability to country.
1 15 24 33 44 54
- Initiate Reports of Discrepancy (DD Form 364).
1 7 23 36 45 57
- Provide tracer action on missing shipments.
1 12 29 37 42 50
- Provide for pilot pickup (foreign air force) of material when requested.
1 5 25 37 45 57
- Consolidate material for follow on shipment
1 15 24 39 40 52
- Provide consolidated bill of lading to country.
1 14 23 39 41 53
- Provide containerized shipment service if requested to do so.
1 13 29 38 40 50
- Inspect material upon receipt at this facility.
1 9 24 33 48 55

16 Other (please specify)

1 2 3 4 5

REGISTRATION

From the list of facilities below, please indicate how important you feel each contributes to an efficient Freight Forwarder operation.

SCALE:

1 = extremely important 4 = not very important
 2 = very important 5 = extremely unimportant
 3 = important

1 Adequate warehouse space.

1 2 3 4 5

2 Adequate personnel to perform each function.

1 2 3 4 5

3 Separate personnel for each country program.

1 2 3 4 5

4 Separate storage areas for each program.

1 2 3 4 5

5. Secure storage areas for pilferable items.

1 2 3 4 5

6. Controlled climate storage facilities.

1 2 3 4 5

7. Other (please specify)

1 2 3 4 5

COMMUNICATIONS/DATA (4)

1 Company Name _____

2 Company Address _____

3. How many years have you been in the international freight forwarding business? AVERAGE 32.7 YEARS

Please use the following space to include any comments you wish to make concerning the questions or your responses in this questionnaire:

DEFINITION OF TERMS

The following general terms and definitions apply to this questionnaire:

SECURITY ASSISTANCE: The group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense related services, by grant, credit or cash sales. As used here, it pertains to the goods or services transferred to non-United States countries or agencies.

FREIGHT FORWARDER: A United States or foreign country owned commercial organization doing business in the United States and which specializes in the movement of goods from the United States to foreign countries. For purposes of this questionnaire, freight forwarders are considered contractually bound to the foreign country.

CUSTOMER OR COUNTRY: As used here, both are considered the same unless otherwise noted. The normal customer of a freight forwarder in this questionnaire is considered the foreign government recipient of Security Assistance material.

DEPARTMENT OF DEFENSE AGENCIES: Those agencies which supply United States military equipment and spare parts. This includes the uniformed services (Army, Navy, Air Force), other government agencies (General Services Administration, etc.), as well as commercial civilian government contractors.

The following terms are identified to specific questions:

QUESTION 2(A): UNITED STATES AIR FORCE POINT OF SHIPMENT: The point where shipment of material leaves USAF ownership control and title passes to the foreign recipient. This may be a USAF facility, a facility of another Department of Defense manufacturer such as the General Services Administration, or another service such as the Army or Navy of the United States.

QUESTION 2(B): FOREIGN GOVERNMENT PERSONNEL: Any representative of a foreign government who is not associated with the United States Department of Defense. This source may be located either inside or outside of the United States.

QUESTION 2(C): THE USAF COUNTRY MANAGER: The Department of Defense representative who is responsible for the Security Assistance programs of the country in question. This person is located at Wright-Patterson Air Force Base, Dayton, Ohio.

QUESTION 4(B): . . .COMMERCIAL: Pertains to any civilian commercial organization which is not contractually bound to the Department of Defense.

QUESTION 8(B): . . .SCHEDULED TRANSPORTATION: Any mode of transportation have a posted, and/or regularly scheduled transportation service which can be obtained in advance.

APPENDIX B

The purpose of this appendix is to acquaint the reader with the Security Assistance Programs of the United States Government. The following information was extracted from The Management of Security Assistance written by the Defense Institute of Security Assistance Management (DISAM). DISAM is a Department of Defense organization located at Wright-Patterson Air Force Base, Ohio.

"One of the primary methods used to carry out our foreign and national security policy has been and still remains through the transfer of defense articles, services, training and economic assistance; or stating it another way, by providing security assistance. Security assistance is considered as an all inclusive "umbrella" term that is defined in the Congressional Presentation Document (CPD). The CPD states:

The Administration places high priority on a balanced Security Assistance Program as an essential instrument of an effective foreign policy, a vital component of the overall US defense effort, and an important complement to our economic aid programs. The challenges are great and constantly changing while the resources we can bring to bear are scarce and restricted.

The Security Assistance Program is not a one way street. When we directly assist other nations in meeting their security requirements, we also make a contribution to our own worldwide defense posture through a stronger collective security framework. In many instances, security assistance is a critical element in our efforts to obtain the access, overflight, and base rights we need abroad. Moreover, virtually all loans and grants made available for foreign military sales, the funds for International Military Education and Training (IMET), and much of the Economic Support Funds (ESF) are spent in the US.

The Security Assistance Program enables our friends and allies to obtain military equipment and training which will help them defend themselves and contributes to the combined defense of common interests. The program also promotes economic and political stability through balance-of-payments support and project assistance under the ESF program. Overall, security assistance reinforces the effect of shared values which underlie our bilateral relationships, providing tangible evidence of US responsiveness and credibility as a dependable, international partner.

For all these reasons, we are proposing a longer, more flexible, and more fully manned security assistance program. The five elements of Security Assistance Program (Foreign Military Sales, Military Assistance Program grants, IMET, ESF, and Peacekeeping Operations) are specifically designed to complement and contribute to the achievement of our national security objectives by developing cooperative political-military relationships with key countries around the world."

"The first years of this decade have witnessed a continued increase in the need for security assistance. Threats to our interests and those of our friends and allies have not abated, but rather in many areas have grown. Defense modernization continues to balloon in cost while the systems needed for this purpose expand in complexity. Many countries must, therefore, continue to look to the United States for the defense articles, services, training, and economic support they cannot provide for themselves but which are necessary for defending their independence and territorial integrity. By providing assistance to nations against potential threats the United States helps to: (1) defend against and deter aggression; (2) contribute to regional stability; (3) demonstrate its concern for the legitimate security problems faced by its friends and allies; (4) diminish both the need and potential for direct U.S. military involvement in local conflicts; (5) avert major economic or political crises; and (6) promote other strategic, political and economic interests."

"Unfortunately, these increasing needs come at the seam time the U.S. has major economic problems at home. Our budgetary resources are stretched thin and belt-tightening is the rule. In this time of scarcity, therefore, the

programs proposed by the President are designed to meet only high priority requirements of national policy."

"In determining these priorities, we have concentrated on those factors that bear directly on important U.S. foreign policy and national security interests. Our focus thus has been on countries: (1) of critical strategic and political importance to the U.S., (2) that are alliance partners with which we have commitments; (3) vital to the U.S. because of the proximity to our territory or other geo-strategic locations; (4) the support of which is critical for key foreign policy and security initiatives; and (5) we depend on for essential raw materials."

"Within the framework of these broad priorities, our assistance programs are in part determined by the commitment of potential recipients to reduce poverty domestically by adopting and implementing sound economic policies; work to eliminate illicit narcotics trafficking, halt the further spread of nuclear weapons, and prevent terrorist activities; as well as promote the protection of the global environment and the basic human rights of their citizens.

The "arms transfer objectives" include:

--To support diplomatic efforts to resolve major regional conflicts by maintaining local balances and enhance our access and influence vis-a-vis the parties;

--To influence the political orientation of nations which control strategic resources...

--To enhance our general access to and influence with governments and military elites, whose political orientation counts for us on a global or regional issues.

--To provide leverage and influence with individual governments on specific issues of immediate concern to us."

"Although we generously provide arms and economic aid to key countries in the unstable regions, our objectives are not always altruistic. We attempt to establish and reinforce relationships in order to assure reasonable access to raw materials that are becoming ever more scarce. Another reason for fostering good relationships is to assure open sea lanes of communication without which we could not readily transport the materials we require or provide seaborne support for us or our allies in time of war."

"We have become critically dependent upon the importation of raw materials from many countries. An obvious example is our dependence on imports to satisfy over

half of our petroleum needs. What is not too generally understood is that the U.S. is more than 50% dependent on foreign sources for over half of the approximately 40 minerals which have been described as critically essential to our multi-trillion dollar economy. Many of these essential materials come exclusively from foreign sources, and some of the most critical of them from highly unstable areas of the world."

"The dangers of high dependence on non-U.S. foreign sources for any item essential to our nation's survival can be illustrated by the OPEC oil cartel which caused: price escalation, shortages, inflation, dollar devaluation, trade deficits and economic stagnation. While oil dependency is the best known and the most important single commodity susceptible to cartel-type actions, it is not the only one."

"Alternate fuels available within the U.S. and from non-OPEC countries make dependency on oil from the cartel less critical. However, there are other materials not internally available and which, if denied to our industrial production effort, would essentially halt output of critical defense items. To preclude such disruption we stockpile large quantities of certain materials. The stockpiles are insurance against dangerous and costly dependence on outside sources during periods of extended national emergency. The materials in the stockpile assure adequate supplies to be on hand to produce increased amounts of essential defense items."

"Developing countries supply about 40-45 percent of the materials which we import for our factories and consumers. Although we are richer in minerals than most industrial countries, the Third World supplies more than half the bauxite, tin and cobalt in addition to 11 other strategic metals and minerals to U.S. industry. For some natural products, such as rubber, coffee, cocoa and hard fibers, the Third World is the source of everything we use."

"The national interests of each of these countries come into play when scarce metals or products represent significant parts, if not the total, of the countries' income. Thus the pressures of the international marketplace and the provision or denial of security assistance may determine our access to these materials."

Security Assistance and Logistics

Logistics plays an important role in all Security Assistance Programs mentioned above. This research is

concerned with the logistics system involved with Foreign Military Sales, the sale and support of military items and equipment to our allied and friendly nations.

Movement of Foreign Military Sales material, while in control of the United States, uses existing military logistics channels. However, once the item is shipped from the point of control or manufacture to the foreign customer, the material is generally moved outside the military system. The foreign government is responsible for the storage and onward shipment of their material. This is normally accomplished using a freight forwarder located in the United States. These freight forwarders are contractually bound to the foreign government and are in no way controlled by the United States Military.

This research addresses the logistics channel used in Foreign Military Sales between the United States Air Force Logistics Command and approximately 65 customer countries. It focuses on the international freight forwarder as a significant member of that channel. The approximately 126 international freight forwarders are agents of the foreign governments involved in Foreign Military Sales with the United States.

APPENDIX C

THE RESEARCH PROBLEM: MILITARY FREIGHT FORWARDERS

The purpose of this appendix is to acquaint the reader with the specific international channels of distribution to be studied in this research. Further, the problems identified in that channel will be presented.

Appendix B introduced the reader to the various Security Assistance Programs of the United States government. The specific programs to be used in this analysis are Foreign Military Sales (FMS) of the United States Air Force. These were chosen from among all programs because of the uniqueness of those programs. Specifically, the rules governing FMS for all military services require that the United States neither make nor lose money in conducting FMS business with foreign nations. This means that all costs of doing business are passed to the foreign government as part of the cost of goods sold. A surcharge is added for administration and management of each program and is used to pay for the personnel and services provided in support of these sales. Additionally, the costs incurred by the United States Air Force in the conduct of its business, the cost of the cost of doing business, are passed to the foreign government as part of the cost of goods sold.

States does not actively "market" military equipment and services. However, as noted in Chapter 1 of this proposal, the United States is in competition with many other nations for sales of military equipment and services as a means to enhance it's foreign policy objectives. In a competitive marketplace, including arms sales, the need to control costs is essential.

The need to control costs goes beyond market competition motives. Since many of the aircraft supported through FMS are the same type as those currently in the United States Air Force inventory, the spares and support equipment used by the foreign governments are the same as those used by the USAF first-line aircraft. In certain instances, contractual agreements between the USAF and the foreign government provide support priorities equal to that of a USAF combat unit. If items ordered by a country become delayed or lost in shipment, both the United States and the foreign country experience reduced readiness and combat capabilities. Unfortunately, losses within the FMS channels of distribution are prevalent.

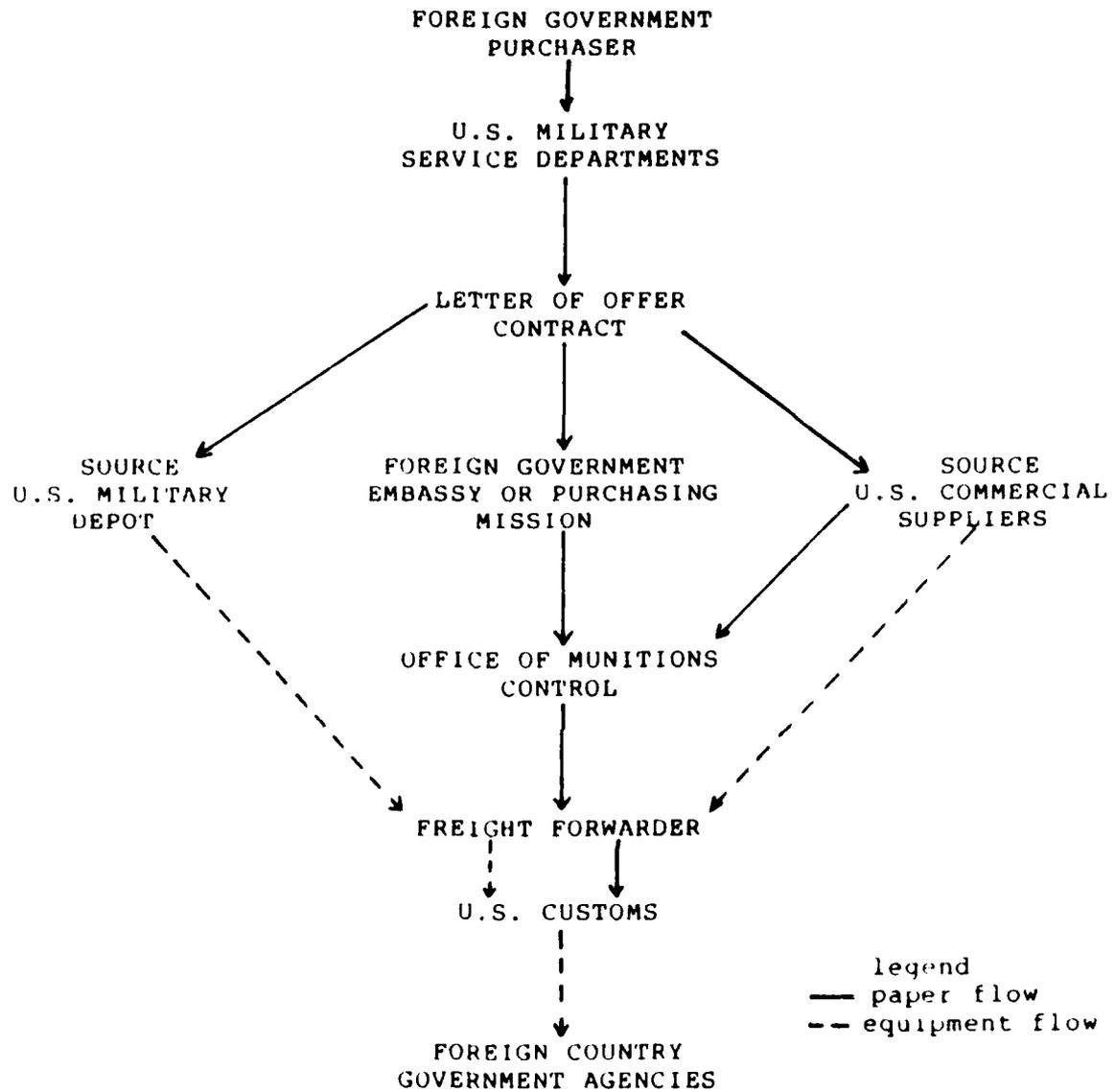
In 1982, over 2 million dollars of military hardware was lost in shipment to foreign countries. Additionally, there was over 20 million dollars of parts or equipment which were received in other than ordered condition, were the wrong item, unsuitable substitute item, and repairable. In addition to these amounts, the United States government was liable for over 1 million dollars which the

customer governments were required to pay over 18 million dollars for items that they never received, were damaged or were other than the items they ordered.¹ Certainly there is a chance for loss, damage or mismanagement at either the USAF supplier end or the foreign country user end of the distribution channel. However, the focus of this study is directed at the military freight forwarder since they are the part of the distribution channel which is outside of the control of the shipper. Freight forwarders are contractually bound to the customer government and are not responsible to the USAF. It is at the military freight forwarder where a great many of the distribution functions are performed and thus provide the key linkages in this international distribution channel.

The international distribution channel used in Foreign Military Sales is shown in Figure 8. It should be noted that all deliveries of military goods, sold as FMS or by a commercial sale of military equipment, are funneled through the country's freight forwarder.

FOOTNOTE:

¹ Compiled from the United States Air Force report: "Security Assistance Program Accounting and Reporting System (HO-511), for Fiscal Year 1982.



Source: Adapted from C.P. Doyle, "Foreign Military Sales (FMS)-A Study of Applicable United States Public Law, Regulations, and Current Problems", The BDM Corporation, December 29, 1983

FIGURE 8

U.S. GOVERNMENT SALE TO FOREIGN GOVERNMENT PURCHASER

APPENDIX D
FORMULATION OF HYPOTHESES

The purpose of this appendix is to explain how the original hypotheses were formed. The hypotheses were an outgrowth of the process which helped develop the research objectives and was conducted much like a Delphi technique. The panel of experts consisted of five members who were associated with the United States Air Force, either as Civil Service or active duty military personnel. One member was assigned to Headquarters, Air Force Logistics Command, three members were from the International Logistics Center, and this researcher served as a panel chairman. The process was iterative and consisted of several steps.

First, panel members were asked to identify what they perceived as the causes for material to be lost in the distribution channel. Each of the panel member's responses was passed to all other members who each had a chance to comment and alter the responses. From the final list of responses, four major categories of functions were identified. These were used as the four main objectives of this research.

The four objectives set the foundation for the individual hypotheses. To come up with hypotheses for each objective a set of variables had to be defined. Therefore,

the next step was to define a list of variables or functions thought to be performed by a typical freight forwarder. The list was passed to each member so they could add items or clarify functions as necessary. The list was then passed to each panel member until a final list of functions was obtained. The next step was to determine how each function could be divided so that specific groups could be formed within each function. Again, each member had several chances to review the list and comment or alter the groups as necessary. The purpose of this step was to determine which variables were most appropriate to identify freight forwarder functions and to determine how best to break the population into specific groups for subsequent analysis and testing. The final list of variables or functions was then made into the individual hypotheses for each research objective.

This research obtained primary data from the population of freight forwarders supporting the United States Air Force Security Assistance Program by using a questionnaire as the data collection instrument. The questionnaire was produced from the collaborative effort of the panel of experts. Each question on the questionnaire was selected to correspond to one of the research variables. To ensure that the correct questions were asked of the forwarders, an iterative process was again used and served to provide a consensus among panel members.

To gather data from the freight forwarders, the final list of variables was then put into questionnaire form and passed to a selected sample of 13 freight forwarders. The purpose of this was to determine if the groups identified by the experts were, in fact, legitimate, understandable and appropriate. None of the test freight forwarders had any problems with the questionnaire nor any suggestions for change. The final questionnaire was printed and sent to the remainder of the forwarders. Results of the forwarders responses were used for data analysis and hypothesis testing and can be found in Appendix A.

For those unfamiliar with the Delphi technique, the following provides a short summary of the technique and how that technique is applied in this research.

History: The Delphi technique is a relatively new method used for "structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem."¹ In the early 1950's, the United States Air Force sponsored a Rand Corporation study to "obtain the most reliable consensus of opinion of a group of experts...by a series of intensive questionnaires interspersed with controlled opinion feedback."² The primary advantages offered by the Delphi technique are its low cost and availability. This technique was developed due to the lack of computer capability and the subjectivity of the estimates for many of the variables that

were under consideration in that initial study. The Delphi technique remains even now to be a very cost effective and efficient method in multiple and diverse applications. While the original use of the Delphi technique was to find a best estimate of certain variables, today it is also used worldwide as a predictive technique, especially where evaluation models require substantial subjective inputs.

Process: Because of the diverse application of the Delphi technique, no single process is universally followed. However, the original Delphi technique consisted of a procedure with three basic features. These were:

- "(1) Anonymity. The opinions of the group are recorded separately--usually by questionnaire--and when communicated to other members of the group are not attributed to specific individuals.
- (2) Controlled feedback. An exercise is conducted in several rounds in which the opinions generated during one round are fed back to the group on the next round, usually in the form of statistical summaries.
- (3) Statistical group response. The "group opinion" is expressed in terms of a statistical score--the median of final responses has proved to be most suitable for numerical estimates."

This process resulted in a convergence of opinion after several iterations. This convergent opinion was then adopted as the "expert" opinion.

While the technique first encountered resistance from management scientists for being too "soft", today the Delphi technique "...has become a fundamental tool for those in the area of technological forecasting and is used today in many

technologically oriented corporations."⁴ High technical areas requiring subjective information into the evaluation models are a prime user of the Delphi technique.

Application of the Delphi Technique to this Research: The purpose of using the modified Delphi technique for this research was to gain the expert's opinions on the types of categories each variable was thought to contain. For example, two of the variables tested were the amount of inspection done by a freight forwarder and the amount of time material was held within a freight forwarder's facilities.

In the former area, the amount of inspection varies from zero (no inspection) to ten percent inspection of items received at the freight forwarder. Many countries presently do not want their freight forwarder to open the boxes to inspect its contents. Those countries which do allow inspection specify between five and ten percent of incoming material to be inspected. The amount of inspection is usually specified in the contract written between the foreign government and the freight forwarder. The panel suggested that the categories for classification should include no inspection, less than 5 percent inspection, between 5 and less than 10 percent inspection, and more than 10 percent inspection of material received by the forwarder.

Those categories were then used in the questionnaire originally sent to the 13 forwarders for pretesting.

The panel of experts' estimate of the material flow time through the freight forwarder was a bit more subjective in nature. After a few iterations it was agreed that five days was a reasonable figure to use as a good break point for the flow time through a freight forwarder's facilities. It was anticipated that the analysis of returned pretest questionnaires would provide a better break point for this variable. As it turned out, the original estimated categories for this variable were considered reasonable by the pretest forwarders and were used in the final questionnaire.

ENDNOTES

1. Harold A. Linstone, and Murray Turoff, The Delphi Method: Techniques and Applications, (London: Addison-Wesley Publishing Company, 1975), p. 3.
2. Ibid., p. 10.
3. N. C. Dalkey, Experiments in Group Prediction (Santa Monica, CA: The Rand Corporation, 1968), p. 4.
4. Linstone and Turoff, p. 11.

APPENDIX E

DECISION CRITERIA FOR DATA COLLECTION: REPORT OF DISCREPANCY

1. Collect all freight forwarder Report of Discrepancy (ROD) code NP, defined as shipped but received with less than ordered quantity. Accumulate all NP RODS for each freight forwarder for the period 1 October 1984 through 30 September 1985.
2. Collect all freight forwarder Report of Discrepancy code NF, defined as shipped but not received by the customer. Accumulate all NF RODS for each freight forwarder for the period 1 October 1984 through 30 September 1985.
3. The following data was obtained from the International Logistics Center data base:

Total Shipments:	551,836
Total RODS(NP):	5,617
Shipment Value:	\$910,213,608
ROD Value:	\$ 40,895,693
Number of Forwarders:	107

APPENDIX F

DECISION CRITERIA FOR DATA COLLECTION: SHIPMENTS

1. Not all deliveries are the result of material shipments. Services fall in this category. In order to correctly capture only shipment data, the program only searched the deliveries for a document number where a valid AS (shipment designator) record is found. Also, it did not access open record files for a given document number unless a valid shipment is found. During inactive processing, open files were never be accessed (logic remains unchanged) since open records would not have enough time expired to have a ROD processed against them.
2. On inactive history records, the extended value was billed for all occurrences with a non-blank delivery source code.
3. For a given document number on active history, the extended value billed for all occurrences was added.
4. The following was used to accumulate the total dollar value:

(unit price) (shipped quantity)-(quantity estimated price-delivered price+quantity actual price delivered)

END

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